American Meteorological Journal.

A Monthly Review of Meteorology
—AND—
Allied Branches of Study.

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THE AMERICAN

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VOL. I. DETROIT, MARCH, 1885. NO. 11.

CURRENT NOTES.

COSMIC ORIGIN OF THE TWILIGHT COLORS.—This is indicated by their reappearance last autumn at about the same time as in the year before. Mr. J. J. Lauderer thinks the phenomenon must have some relation with the swarm of meteors, whose radiant points are in R. A. 7^h and 10^h and Decl. $+ 30°$ and $+ 41°$, or with the meteor-swarm belonging to Biela-Gambart's comet.

THE Roumanian Meteorological Institute is already established; it began observations on July 1st of last year. The Institute is attached to the department of agriculture, industry and commerce, and Mr. St. C. Hepites has been designated as its director, with headquarters at Bucharest. During the current year will be commenced the establishment of other stations (that of Bucharest being already in operation), with a net of which the Roumanian territory is to be eventually covered. The first publication of the Institute is already in our hands. It is a quarto of 164 pages, bearing date of 1884 and printed at Bucharest, and is entitled *Serviculu Meteorologicu in Europa*. It presents the results of the studies of the European meteorological services made by Director Hepites. This gentleman is a voluminous writer, and we have before us the titles of 36 of his papers, all in Roumanian, the most of them on meteorological topics.

THE French meteorologists are paying especial attention to the promising field of observations at considerable altitudes. They have already established observatories on the Puy-de-Dôme in south central France, and on the Pic-du-Midi in the mid-Pyrenees. A new one is in process of construction on Mont Ventoux, in the extreme south of France, not far north of Marseilles. It is described in *La Nature* for Nov. 22, 1884, a copy of which we owe to Col. D. A. Robertson, of St. Paul, now in Paris. The buildings are just below the peak, while the latter is the actual station of observation. It is at an elevation of 1,908 metres (6,285 feet), and is approached by a covered passage-way from the buildings, 40 feet lower. The buildings are in an advanced stage of construction.

SIMPLE DEMONSTRATION OF VERTICAL AND CYCLONIC CURRENTS.—In a recent meeting of the Berlin branch of the German Meteorological Society, Prof. Börnstein showed by a simple experiment the formation of ascending currents, and their modification by the rotation of the ground on which they stand. A large plate of window glass is placed on four legs high enough to admit the hand underneath. A large bell-glass is placed on the pane, and a little tobacco smoke is cautiously introduced through an orifice in the top along a glass tube reaching nearly to the bottom. On removal of the tube the smoke makes a layer at the bottom of the bell-glass half a line to a line deep. Now bring a heated body—the end of a lighted cigar—near the pane from below, at about the center of the bell-glass, so as to warm that point of the pane. Above this spot the smoke will rise in a vertical column, which, on account of the friction, will widen out above into the shape of a trumpet, or toadstool.

In order to show the modification due to the rotation of the earth, place a closed, quadrangular glass-box on a centrifugal machine, and after warming a point in its bottom set it slowly in rotation, so that the air may take smoothly the rotation of the box. A long rectangular box is better than a square one. When the air is at rest relative to the box, introduce smoke from the top into one corner of the box: in this case the introducing tube need not be withdrawn. The smoke gradually spreads itself over the bottom and rises from the warm point, at first exactly as before, but finally taking on a spiral form in which cyclonic lines are shown in a very clear and very natural manner.

ROYAL METEOROLOGICAL SOCIETY.—The annual general meeting of this society was held on Wednesday evening, the 21st of January, at the Institution of Civil Engineers, Mr. R. H. Scott, F.R.S., president, in the chair. The secretary read the report of the council, which showed the society to be in a very satisfactory condition. The council equipped a typical climatological station in the grounds of the International Health Exhibition, in order that persons desirous of organizing a station, might see one arranged in accordance with the regulations of the society. A conference on "Meteorology in relation to Health" was arranged for by the society, and held at the health exhibition on July 17th and 18th. The council have appointed committees to investigate the subjects of the brilliant sunrises and sunsets of 1883–4, and of the local phenomenon known as the helm wind of Cross Fell, Cumberland. The observing stations of the society now number 85, the results from which are printed in the *Meteorological Record.* The whole of the stations in the south of England have been inspected during the year and found to be generally in a satisfactory state. The number of Fellows on the roll of the society is 552, of whom 37 were elected in 1884.

The president, Mr. R. H. Scott, then delivered his address, in which he stated his intention to treat of the general state of the science of meteorology over the globe, as compared with the programme sketched out by Prof. James Forbes in the report of the British Association, 1840. He said there were now six meteorological societies publishing journals, and in addition six periodicals almost exclusively devoted to the science. He went on to say: "With all the wealth of literature there is one particular in which, in this country at least, our science labors under a great disadvantage. So far as I am aware, no instruction is given in it except at the Royal Naval College, Greenwich. In Germany, in the current half year, no less than eleven courses of lectures are announced at as many universities and high schools." Mr Scott exhibited a large map showing all the observing stations over the globe, and also the distribution of information as to ocean meteorology as contained in the meteorological office. He then alluded to the different classes of observation proposed by Prof. Forbes for the different classes of stations, and the degree to which his suggestions had been carried out. The next subject was the attempts which have been made by balloon ascents, mountain stations, etc., to gain a knowledge of the condition of the upper atmosphere, and Mr. Scott stated that on enquiry from the various foreign institutions which possessed affili-

ated mountain stations, he had found that except in the case of Mount Washington none of the observations were practically much used in forecasting. No telegrams are received from Pike's Peak. In one particular all authorities are agreed, that no one has yet suggested any mode in which the barometrical readings could be used, owing mainly to the uncertainty about their reductions to sea level from great heights. Mr. Scott concluded his address with a notice of the important work by Padre Vines, S. J., of the Havannah, on the West Indian hurricanes of 1876 and 1877.

The following gentlemen were elected the officers and council for the ensuing year:

President—Robert Henry Scott, M.A., F.R.S., F.G.S. Vice Presidents—William Morris Beaufort, F.R.A.S., F.R.G.S.; John Knox Laughton, M.A., F.R.A.S., F.R.G.S.; Edward Mawley, F.R.H.S.; Charles Theodore Williams, M.A., M.D., F.R.C.P. Treasurer—Henry Perigal, F.R.A.S. Trustees—Hon. Francis Albert Rollo Russell, M.A.; Stephen William Silver, F.R.G.S. Secretaries—George James Symons, F.R.S.; John William Tripe, M. D., M.R.C.P.Ed. Foreign Secretary—George Mathews Whipple, B.Sc., F.R.A.S. Council—Edmund Douglas Archibald, M.A.; George Ghatterton, M.A., M.Inst.C.E.; John Sanford Dyason, F.R.G.S.; Henry Storks Eaton, M.A.; William Ellis, F.R.A.S.; Charles Harding; Richard Inwards, F.R.A.S; Baldwin Latham, M.Inst.C.E., F.G.S; Robert John Lecky, F.R.A.S; William Marcet, M.D., R.R.S., F.C.S.; Cuthbert Edgar Peek, M.A., F.R.A.S., F.R.G.S.; Capt. Henry Toynbee, F.R.A.S.

Winter Thunder.—Baltimore, as we learn from Mr. John R. Hooper, had a thunder storm on February 9–10, and this was followed within a few hours by a drop of 35° in the thermometer and unusually cold weather. The weather proverbs are remarkably uniform in all European languages in indicating winter thunder as a bad sign. "Winter thunder, poor man's death, rich man's hunger;" "Tonnerre d'hiver, tonnerre d'enfer;" "Donner im Winter Quartal, bringt uns Kälte ohne Zahl," etc., etc. One reason of its bad augury, perhaps the only one, is probably that a winter thunder storm means a severe sudden change in temperature. A summer thunder-storm usually brings a great fall in temperature. In Ann Arbor in summer the thermometer may fall 20° or more—sometimes 35° or 40°. This might not be dangerous in summer, but such a fall in winter, following a rain, would be apt to be destructive to all winter crops, and thus decrease the yield of the next season.

SIGNAL SERVICE HOURS.—The hours of our Signal Service observations and those of the international bulletin were changed on January first, so as to correspond with the general system of "standard time." They are now taken at our stations at 7 A. M., 3 P. M., and 11 P. M., eastern standard time, and for the International bulletin at Greenwich mean noon.

MEASURE OF DEW.—Prof. L. O. Ferrero has been carrying on observations on the amount of dew at Turin. For collecting it he made use of fustian as most similar to the texture of the surfaces of leaves. He found during the summer the average amount of dew each night was 130 grammes per square metre (186 grains per square foot).—*Ciel et Terre.*

CALIFORNIA WINTER.—Our extremely cold winter does not seem to extend to California. In the summary for January, published in the *Weekly Mirror*, we learn that the temperature at Los Angeles was 53°.9' for January. This is exactly the same as last year, and it has not been surpassed in 7 years, only by that of 1878, when the mean was 54°.9. The thermometer ranged last January from 38°.0 to 71°.6.

ELECTRICITY FOR FRUIT-GROWERS.—At last, according to the *Journal des Debats*, we have an application of electricity for fruit-growers. It relates to protecting tender plants from late frosts. It is well known that smoke covering a field will protect it from light frosts, and the French vine-growers have heretofore been obliged to have heaps of materials ready and watchmen to light them when the thermometer approached the danger point. The proposal now is to have electricity do the work of the watchman, for, unlike him, it is never sleepy nor careless, nor does it ever use reason to be mistaken as to the nights on which frost may occur. By an apparatus easily conceived, an electric circuit can be closed when the temperature falls to 32° or any other desired point, and opens when the temperature rises above this point. With such an apparatus, the plant for the field would be, a heavy battery, wires passing through the piles of combustibles and interrupted in them by a short stretch of material of high resistance in contact with highly inflammable kindling, and the electric watchman would be ready. It is estimated that the original plant would cost about eight dollars an acre. The subsequent cost would be small.

THE investigation of tornadoes, so well begun last year by the Signal Service, will be continued during the coming season under Lieut. Finley's direction as before. The most important feature in the plan of work is the aid received from volunteer observers, whose number should be increased, so that no tornado can escape odservation. All persons in the tornado states who will undertake to furnish the simple record desired, should apply to the Chief Signal Officer (Washington, D. C.) for instructions. The latest circular issued is as follows:—

SIGNAL OFFICE—WAR DEPARTMENT.

Washington City, ... *188* .....

SIR: This circular, with the accompanying map of the observer's state, is sent you in hopes of securing a more complete and reliable record of the tracks of tornadoes, both past and recent. The division lines separating counties and townships, also the location of county seats, railroad lines, and rivers are sufficiently well defined on this map to permit of locating, with a considerable degree of accuracy, the tracks of tornadoes. Please observe the following directions for the use of map:

1. The tornado tracks will be entered in red ink, if possible.
2. A single line of uniform width will represent the track.
3. Where the tornado cloud lifts from the earth and remains above it for a considerable distance, leaving a gap in the path of destruction, the line representing the track should be broken.
4. On the southern side of the line record the month, day, and year when the tornado occurred.
5. At the beginning of the line record time, in hours and minutes, of the first appearance of the tornado cloud. Give the time of day as shown by the observer's watch, and state also both the error of the watch and the standard by which it is regulated.
6. Great care should be taken to represent the true general direction of the path of destruction. Any small irregularities in the course of the tornado cannot properly be indicated on maps of the scale used for this work, and, therefore, will be omitted, and the line will be drawn to represent the average or general course of the tornado.
7. Marked departures from the general course of a tornado, amounting to a mile or more, can, however, be indicated on the map; small deviations not shown on the map should be noted in the description of the storm.
8. There may be recorded on a single map more than one tornado unless two or more separate storms have passed over the same ground, in which case the tornado tracks must be recorded on separate maps.
9. A report of the various storms recorded thereon should accompany each map of tornado tracks. These reports will be on Tornado Circulars Nos. XI and XIII.

10. This map, and the report of the tornadoes thereon should be returned to this office by the close of the current month, except where the tornadoes reported are unusually violent and destructive, in which event the information should be forwarded as soon as the record of the storms is complete.

Thunder-storms will also receive especial attention, as last year. These studies are in charge of Prof. H. A. Hazen, of the Signal Service, from whom brief announcements of the valuable results already gained have been made in recent numbers of the *Monthly Weather Review*. A new edition of the circular of instructions for the simple observations desired is now in preparation, and will shortly be ready to send to applicants in all parts of the country. A peculiar feature of both of these lines of investigation, is, that they do not require fixed observations, but can be made about as fully when travelling from place to place as while staying at home. Applications should be made, as above, to the Chief Signal Officer.

OZONE AND CHOLERA.—In a note in the *Comptes rendus* (Dec. 15, 1884) Mr. Onimus calls attention to the marked diminution of atmospheric ozone during the recent cholera epidemics in France. At Marseilles the average of ozone was only 0.86 during the cholera, while for the same time in 1883 it was 2.17. In Paris it was exactly observed at the observatory at Montsouris. From Oct. 30, to Nov. 15, 1884 (the worst of the epidemic period) the average ozone was 0.27, while it was 2.00 for the first 15 days in Nov. 1883. The author thinks that the relation of ozone to cholera is that the presence of the gas interferes with, and its absence permits, the "hatching." (*Éclosion*) It is not easy to manufacture ozone, and Mr. Onimus recommends the use of Beck's ozoneine.

TAN VATS AS BAROMETERS.—Mr. J. Cholon writes to *Ciel et Terre* that all tanners know that when the liquid rises in the tan-vats, rain is imminent. They have thus an infallible barometer always at hand. They most of them think they have in this a phenomenon due to variable humidity, and the others – – – do not trouble themselves with thinking about it. As there are no deliquescent substances in the vats, the question of humidity can play no part in the explanation of the phenomenon; and as the temperature is kept constant, there can be no expansion due to heat. The leather is porous and holds in its innumerable closed pockets free gases or liquids rich in dissolved gases; when the pressure of the air diminishes, these gases must expand, the leather swell, and the liquid rise in the vats.

RETARDATION OF THE SEASON BY ALTITUDE.—M. Alf. Angot in a communication to the French Academy (*Comptes rendus*, 5 Jan. '85) presents the results of a study of the retardation of the development of plants, and change of migration of birds, with increase of elevation above the level of the sea. Great care was taken to avoid accidental variations, and the field of study included the whole of France. From the times of appearance in 1881, of the leaves of lilac, birch, horsechestnut and oak, the flowering of narcissus, gooseberry, lilac, horsechestnut, elder and basswood, and the harvest of rye and winter wheat, the retardation was found to be on the average, exactly 4 days for each 100 ms. of elevation. In 1880 it was made 3.9 days. The individual variations are not so great as to deprive the result of confidence. This is equivalent to about 12 days for every thousand feet. The arrival of the chimney swallow was retarded 6.3 days for every thousand feet, but the dates of its departure were irregular, averaging about two days acceleration, for every thousand feet. The woodcock arrived also 6.3 days later, but departed pretty regularly 3.6 days later. Similar studies in the United States would be of interest.

THE second of the prizes offered by Mr. Warner is of interest to meteorologists. It is to be hoped that it will call out a good digest of the great mass of desultory publications and notes which have been published on the subject in the last year and a half. Below we give the character and conditions of the prizes as they are given in Mr. Warner's circular.

It is a gratifying fact that very many astronomical discoveries, and those of great importance have been made during the past few years. I think this is due in part to the impetus given by the competition for the honors and prizes awarded to discoverers, and in order that this interest may to that extent be continued and sustained, I offer

First. Two hundred dollars for each and every discovery of a new comet made from February 1st, 1885, to February 1st, 1886, subject to the following conditions.

1. It must be discovered in the United States, Canada, Mexico, West Indies, South America, Great Britain, and the Australian Continent and Islands, either by the naked eye or telescope, and it must be unexpected, except as to the comet of 1815 which is expected to reappear this year or next.

2. The discoverer must send a prepaid telegram immediately to Dr. Lewis Swift, Director Warner Observatory, Rochester, N. Y., giving the time of discovery, the position and direction of motion with sufficient exactness, if possible, to enable at least one other observer to find it.

3. This intelligence must *not be communicated to any other party or parties*, either by letter, telegraph or otherwise, until such time as a telegraphic acknowledgment has been received by the discoverer from Dr. Swift. Great care should

be observed regarding this condition, as it is essential to the proper transmission of the discovery, with the name of the discoverer, to the various parts of the world, which will be immediately made by Dr. Swift. Discoverers in Great Britain, the Australian Continent and Islands, West Indies and South America are absolved from the restriction in conditions 2nd and 3rd.

Second. I will also give a prize of $200 in gold to any person in the world who will write the best 3000 word paper on the cause of the atmospheric effects ["red light" etc.,] accompanying sunset and sunrise during the past sixteen months. It is desired that these papers be as original as possible, both in facts, observation, and treatment.

Essays must be exclusively sent prepaid to Dr. Lewis Swift, Director Warner Observatory, Rochester, New York, must be written in English, on one side of the paper only, and must be in the simplest, untechnical phrase. Each competitor must sign a nom de plume to his essay, and enclose his real name and address in an envelope, superscribed with his nom de plume. The essays must be in Dr. Swift's hands by Dec. 1, 1885.

Three disinterested scientists will be selected to determine the result, and also to settle any dispute that may arise regarding comet discoveries.

H. H. WARNER.

ROCHESTER, N. Y., Jan. 17, 1885.

MR. SHERMAN'S PREDICTIONS.—The following guarded prediction appeared in the Port Huron *Times*, for Feb. 7.

The period of prevailing cold weather forecast by the *Times* Jan. 16, came very promptly, and has continued with slight and short rises of temperature until the present time. Our prediction was based upon the observed movements of areas of heat and cold eastward across the continent; andstill making use of these movements, we estimate that the present area of camparative warmth now prevailing in Dakota will reach this section the 15th of this month, or between the 13th and 18th. About that time we anticipate the opening of a period of prevailing mild weather, which will last two or three weeks at least, and may perhaps precede an early spring. It is probable, however, that there will be a subsequent cold period.

The area of cold weather this season was first observed in Washington and Montana territories early in December, extending soon into Dakota, and reaching Michigan about the middle of January. It is only within the past week that this area has reached the Atlantic coast in Massachusetts, the weather having been very mild there, with scarcely any snow up to February 1st.

At the present time the grass is reported to be as green as in May in the Willamette valley, in Oregon, where, in December the snow was two feet deep. The area of warmth appears to have reached Montana, where 50 degrees below zero was common early in January, and its edge is in Dakota. The readers of the *Times* who care to take the trouble may find it interesting to watch its advance eastward, through the signal service reports and special telegrams.

THE reddish brown glow about the sun mentioned in the October and February Nos. of this JOURNAL has been, at Ann Arbor, distinctly visible about the sun on every fair day during the autumn and winter. At the last two or three periods of full moon, a similar glow, though less distinct, has also been noted about the moon by two or three independent observers. This glow was quite distinct on the evening of Jan. 28. H. H. C.

GLASS FOR THERMOMETERS.— The Prussian royal commission of weights and measures, to which so many important studies are due, has been making an investigation of errors of thermometers due to the slowness and incompleteness with which glass follows changes of temperature. It is known that if the temperature rises until a certain degree is shown and then falls, the glass is apt to not accompany the mercury at once in its shrinkage, and a depression of the zero point results. This is partly temporary, but may also be in part permanent. The commission has reached the remarkable result that it depends on the relatively simple or compound character of the glass. If the glass contain equal or nearly equal parts of potash and soda, this phenomenon is at its maximum, which may be 1° F. or more; but if one of these alkalis preponderates over the other the error becomes smaller, and is reduced to a minimum, when the glass contains either soda or potash, to the exclusion of the other. Thus, with glass containing 13 per cent. potash and no soda, or 15 per cent. soda and no potash, the error was 0°.13 F., while in one containing equal parts of the two, the error was 1° .52 F.

EARTHQUAKES IN SPAIN.—Shocks were still felt occasionally up to February 16. On this date they were felt at Grenada, Vilez, and Matril. The movement began on December 22. A close connection is found to exist between the character of the shocks and the underlying geological structure. In a recent number of *Comptes rendus* (26 Jan. 1885), Mr. A. F. Noguès describes some of the most notable physical changes which have resulted from the earthquakes. Numerous cracks and fissures have been formed. One of the most remarkable is near the village of Zaffarraya; it is twelve miles long. Another near Guevejar is nearly two miles long, 10 to 50 feet across and of a great but unknown depth. Near Alhama is a great crack from which comes a gas with the odor of rotten eggs which is perceptible over half a mile away. It also furnishes a

new and abundant spring of sulphurous water with a temperature of 108° F. There are many places where the soil has been shifted sideways; in one case houses were carried 90 feet. Changes of level have been common. The source of the river Almachar was lowered, its bed fissured, and it rendered useless for irrigating the neighboring lands.

MR. BUYSMANN, of Flushing, Holland, kindly furnishes the following reviews of European weather:

REVIEW FOR OCTOBER.

Barometer Pressure—From the 1st until the 3rd, there is a low pressure in the N. W. and a high pressure in the N. E., but on the 4th the minimum has reached North Norway. On the 5th there is a maximum over Britain, where the barometer has risen to 30.71, with calm, clear weather. This high pressure spreads on the 6th over Scandinavia and West Russia, while a slight minimum has appeared over Italy. On the 8th another low pressure is observed in the N. W., a part of which has traveled to the S. E. and united itself with the minimum over the Mediterranean, so that a region of low pressure separates two maxima: one to the S. W. and another over Russia. On the following day there is a minimum over the Bristol canal and another over Denmark; then low pressures travel northward so that one is observed on the 10th over the North Sea and the other over Scandinavia; the first causes strong to stormy north and northwesterly winds over the British Isles, with low temperatures down to 35° (Stornoway). On the 12th the low pressure over the North Sea has travelled to Stockholm, while a maximum appears on the western shores of Britain. On the 15th the minimum just mentioned is situated in the vicinity of St. Petersburg, after having caused considerable precipitation over Germany and Scandinavia. Another low pressure is observed near the Norwegian coast and on the following day over the Baltic (barometer at Stockholm 29.24), causing severe gales on the northern shores of Germany and snow over Finland and North Scandinavia; another depression on the western shores of Norway has travelled eastward and is observed a little west of Stockholm, causing stormy winds over Germany and severe storms over Denmark; this depression travels southeastward and hovers on the 18th over Russia (barometer at Kiew 29.02), causing much precipitation over Austria and northern Germany. On the 19th another disturbance appears on the north Norwegian shore, and reaches on the 20th Riga, on the

western coast of Russia. In the southwest over the Gulf of Biscay there is a continual high pressure, with temperatures up to 57° (Ireland), but this maximum spreads on the 21st over Holland, France and Germany, with cloudy weather, while the low pressure over the Baltic disappears in the northeast and another is advancing on the Norwegian shores, under the influence of which the temperature has risen in Finland from 20° to 48°, with rain. The high pressure travels eastward, and on the 25th is situated near Kiew (Russia), while a minimum appears on the western shores of Britain, but is nearly filled up on the 24th. Under the influence of the high pressure in the east, easterly winds prevail in central Europe, with most clear weather with low temperatures. On the 25th there is a low pressure in the northwest; a slight depression over Germany causes there considerable precipitation; the low pressure in the northwest is observed on the 26th near the Shetland Isles, where the barometer has reached the extraordinary low stand of 28.32, causing very severe storm over Denmark, storm over Finland and Norway, and stormy winds over northwest Germany and Britain. Much precipitation has fallen over south Norway (up to 1.57 inches.) On the 27th the minimum is situated near Christiansund, on the Norwegian shore (barometer in Christiansund 28.15), with continual storm in its vicinity; it disappears, however, on the 28th in the north. Another depression from the ocean has reached on this date the eastern shores of Scotland, and hovers over the North Sea (barometer at Aberdeen 28.65), causing stormy winds and much precipitation over the British Isles and Germany. On the 29th the depression has reached the southwest part of Finland (Tamnerfoss 28.70); under its influence the winds on the northern shores of Germany and over Denmark have risen to very storm (Königsberg reports at 9 P. M. of the 28th and at 8 A. M. of the 29th): Hurricane from southwest with rain; Sylt (Denmark), hurricane and several *houses* blown away; Riga, severe storm; Stockholm, ditto. On the 30th the minimum has disappeared in the northeast, and another advances from the west; a high pressure has spread over France, Germany and western Russia, with foggy weather and falling temperature. On the 31st the depression in the northwest has reached the north Norwegian shore (barometer at Bodö 29.07), causing stormy winds over south Norway and Britain, with unusually high temperatures.

Temperature—Germany.—The temperature is: from the 1st until the 10th, from the 16th until the 23rd, and from the 28th–29th,

above (up to 14°), and from the 11th–15th, from the 24th–27th, and from the 30th until the 31st, under (down to 10°), the mean temperature of the month. Direction of the wind, most southwest, west or northwest.

REVIEW FOR NOVEMBER.

Barometer Pressure—On the 1st there is a high pressure over Russia, where the barometer has risen to 30.75, and a low pressure in the northwest. This depression has reached north Sweden on the 4th, while a new disturbance approaches on the British coast. Moving northeastward this minimum has travelled to north Scandinavia—the high pressure is now situated over Italy. The area of low pressure disappears in the northeast, but another has developed over Ireland, travelling on the 8th to north Norway, causing strong to stormy west and southwest winds over south Scandinavia and Britain, changing on the 9th to a quite severe storm; high pressure has spread over central Europe with fog and cloudy weather, moving on the following day to Belgium and Holland; the low pressure now disappears in the northeast. An area of high pressure spreads on the 11th over west Europe, causing clear weather in Scandinavia, but over central Europe the cloudy and foggy state of the sky continues. Another maximum appears on the 13th over Ireland, uniting itself with the high pressure over Europe. Frosts are now reported from Germany, Austria, and France. An area of relative low pressure hovers over Germany on the 18th, moves to northwest Russia, and causes on its way everywhere rain and snowfall, dividing the high pressure over central Europe in two parts; one is situated in the northwest, the other in the southeast. On the 20th a low pressure appears on the Norwegian shore; moving in a southerly direction, on the 21st it has reached Holland, causing snow and rain, but on the 22nd it has disappeared. Another depression hovers over Scandinavia, spreading to north Germany. Over Italy an area of low pressure is also observed. In the west the high pressures remain stationary. Frost increases now in Germany. A minimum appears on the 25th over northern Norway; out of this low pressure another minimum has developed on the north German coast, causing there severe storm and rain; on the 30th both depressions are to be found as an area of low pressure in the southeast. Another disturbance approached on the northwest shores of Scotland. Frost is now generally in Scotland, England, France and Germany.

Temperature in Germany.—From the 1st—3rd, 12th—27th, 29th and 30th it is below; from the 4th—11th and on the 28th it is above the mean temperature of the month. Lowest temperature 5°, at Königsberg on the 25th; highest, at Kaiserslantern on the 7th, 62°.

Russia, St. Petersburg.—From the 1st–15th, the temperature is above, and from the 14th–30th it is below the mean. Lowest temperature on the 22nd and 23rd, 7°; highest on the 1st, 46°.

Valentia, Ireland.—The temperature was above the mean on the 1st, 3rd, 5th, 8th, 12th, 14th, 16th, 26th and 30th. It was below on the 2nd, 6th, 7th, 13th, 17th and 25th. Lowest temperature 32° on the 25th; highest, 55° on the 11th.

REVIEW FOR DECEMBER, 1884.

Barometer Pressure.—On the 1st and 2nd there is a high pressure over France extending to north Norway, separating two depressions —one over western Russia, causing there snowfall, and another in the northwest with rain and stormy weather over Britain; quite severe frosts are reported in Germany. The minimum in the northwest hovers on the 3rd over Scotland, where the barometer has fallen to 28.94. On the 4th it is divided into two depressions, one of which has travelled on the 5th to Denmark, causing severe storm, rain, and considerably higher temperature over Germany; the other disturbance remains northwest of the Shetlands. The minimum over Denmark and the Baltic has disappeared on the 7th. The main depression in the northwest has moved on the 8th to the Norwegian shore, and on the 9th is situated over Finland. Another depression appears on the 11th on the Norwegian shore, and on the 12th is central near Stockholm, causing continual precipitation over Germany, Holland, Denmark and Scandinavia. This disturbance disappears on the 13th in the northeast, but another appears on the 16th sending out a branch to the east, and on the 17th another to the south; the temperature has now fallen in Germany. This state of things remain the same until the 20th, when a third and intensive depression has developed on the North Sea, with a stand of the barometer in the centre of about 28.54, causing a hurricane-like storm over Britain and severe storms over western France. Traveling rapidly in a southeast direction it hovers on the 21st over Italy, causing at Lesina, on the Adriatic coast, hurricane-like storm from the south. A high pressure follows in the west and extends on the 23d to Russia. Under the influence of the easterly winds caused by the depression in the south, the temperature in Germany and Austria has fallen. The

maximum disappears in the northeast, but another appears in the west, while a depression has formed over north Europe. The depression in the south, however, joins on the 25th the minimum in the north, and an area of low pressure extends from north Norway to Italy; yet the pressure is equally distributed and light frosts prevail. The high pressure in the west spreads on the 26th and 27th to Russia, and reaches on the 29th 30.55. Traveling eastward the maximum hovers on the 30th over Russia, while an area of low pressure extends over west Europe. On the 31st, however, the high pressure increases and spreads to the British Isles, the barometer over Finland rising as high as 31.02.

Temperature, Germany.—From the 1st until the 3rd, and from the 25th until the 27th, it was below; from the 4th until the 24th, and from the 28th until the 31st, it was continually above the mean. Highest temperature on the 8th at Münster, 57°; lowest on the 2nd at Bamberg, 3°.

Russia—Petersburg.—From the 1st until the 8th, 14th until the 19th, and on the 24th it was below; from the 9th until the 13th, 20th until the 23rd, and 25th until the 31st it was above the mean. Highest temperature on the 9th and 12th, 35°; lowest on the 24th, 4°.

Ireland—Valentia.—From the 1st until the 7th, 9th until the 16th, 18th until the 21st, and 29th until the 31st it was above; on the 8th, 17th, and from the 22nd until the 28th it was below the mean. Highest temperature on the 13th, 55°; lowest on the 24th and the 27th, 34°.

Sweden—Stockholm.—From the 4th until the 5th, 7th until the 13th, on the 15th, from the 17th until the 22nd, on the 27th, and from the 29th until the 31st it was above; from the 1st unil the 3rd, on the 6th, 14th, 16th, from the 23rd until the 26th, and on the 28th it was below the mean. Highest temperature on the 9th, 41°; lowest on the 1st, 5°.

THE COLORADO METEOROLOGICAL SOCIETY was established at Denver on January 6 of this year. It will undoubtedly do much for meteorology, and it has a particularly interesting field of work. The account of the first meeting, which follows, was clipped from the Denver *Tribune-Republican:*

A meeting was held in the ladies' reception room of the Windsor Hotel last night for the purpose of organizing a State meteorological society. It was the outgrowth of a belief on the part of several gentlemen interested in the subject, that the signal service of the

Federal Government in Colorado was not complete enough, and that it should be supplemented by the work of a State organization. The only United States signal stations in Colorado are those at Denver, on Pike's Peak, and one recently established in the old Ute reservation As many of the storms which pass over the western country originate in the Rocky Mountains, it has been thought best to have a very thorough service here. A storm may originate in the northern or southern part of the State, and pass out over the plains to the east without seriously affecting, if at all, the observations at either Denver or Pike's Peak. Several of the States have organized these supplemental associations for the purpose of making the meteorological service more efficient, and in these cases State aid is given. Here it is expected that the United States Government will furnish the instruments to be used, and that the members of the society will then make the observations gratuitously.

The meeting last night was well attended by gentlemen who appreciate the importance of this work. The following gentlemen were present:

C. F. Wilson, L. M. Cuthbert, Judge Platte Rogers, Dr. L. E. Lemen, J. T. Cornforth, E. R. Murphy, Joseph Milner, Dr. S. A. Fisk, Prof. S. A. Short of the Denver University, Prof. C. F. Davis of Fort Collins, Prof. F. H. Loud of Colorado Springs, H. W. Hobson, E. L. Scholtz, E. S. Nettleton, State Engineer, Dr. J. H. Kimball, Dr. C. A. Roberts, Dr. Rogers, Dr. Charles Denison, and W. S. Jackson, Receiver of the Denver & Rio Grande Railway.

Mr. C. F. Wilson was elected chairman, and Dr. S. A. Fisk, secretary.

Prof. Short, from the committee on "Articles of Incorporation," reported certain articles which, after a few amendments, were adopted as follows:

Know all Men by these Presents:

That we, C. F. Wilson, S. A. Fisk, S. A. Short, J. F. Cornforth and E. A. Nettleton, citizens of the United States, have this day associated themselves together for the purpose of forming and incorporating themselves into a corporation to be known by the name of "The Colorado Meteorological Association."

Article 1. The objects of said corporation are for other than pecuniary profit being entirely for the purpose of observing, collecting, recording and publishing the meteorological phenomena, occurrences and changes within the State of Colorado, and for all purposes and objects connected with, incident to or necessary for the effective carrying out of the above purposes.

Art. 2. The government, management and control of said corporation shall be vested in a board of directors, consisting of nine, and the directors for the first year of the existence of said corporation shall be as follows: S. E. Short, F. H. Loud, C. F. Davis, Paul Hanus, Charles Dennison, S. A. Fisk, James Gilligan, Charles F. Wilson and E. A. Nettleton.

Art. 3. The directors shall at the first meeting, held after the incorporation of said association, elect from their number a president, and a first, second and third vice president, and at the first meeting after each annual meeting of the corporation, beginning with the year 1886, the directors shall elect similar officers. Said officers shall serve from the time of their election until the next annual meeting of said corporation, or until their successors shall have been duly elected and installed.

Art. 4. The directors shall, at the first meeting aforesaid, elect an officer to be known as secretary and treasurer, who shall be subject to removal at any time by the directors, and who, unless so removed, shall hold his office for the same term as that of president.

Art. 5. The annual meeting of this association for the year 1886 shall be held on the 4th day of January, 1886, and the subsequent annual meetings shall be held upon such day in January in each year as each preceding annual meeting shall designate.

Art. 6. The principal office and place of business of said corporation shall be in the city of Denver.

Art. 7. At each annual meeting the members of said corporation shall elect their directors in such manner as may be provided by the By-Laws.

Art. 8. The officers of said corporation, including the directors, shall have such power and duties as may be prescribed by the by-laws other than those set forth in these articles of incorporation and not in conflict herewith.

Art. 9. As soon as practicable after this incorporation the Board of Directors shall adopt such By-Laws as may be necessary for the government of said corporation and for the carrying out of the purposes thereof, which may be repealed, amended or added to at any meeting of the directors by the vote of a majority of said board of directors.

After the articles of incorporation were adopted a motion was made that a committee of three be appointed by the chair to report the names of members of the association for the positions of directors. The chair appointed on this committee Messrs. Short, Cuth-

bert and Cornforth. The committee soon returned and reported the names of the gentlemen already given in the articles of incorporation as directors, who were thereupon duly elected. The meeting of the association then adjourned.

Immediately following the adjournment of the association's meeting a directors' meeting was called, but nothing was done other than to adjourn to Friday evening of this week to the residence of Mr. C. F. Wilson, No. 313 Curtis street.

METEOROLOGICAL STATIONS IN THE ATLANTIC.

The widespread and increasing interest taken in the information furnished by the U. S. Signal service, as shown by requests to establish signal stations throughout the country, should be met by establishing meteorological stations in the Atlantic over or near the commercial cable lines, when they would be in communication with both sides of the Atlantic.

The practicability of such stations has been demonstrated by the cable-laying steamship Faraday while laying the cable between France and the United States, and, holding on to the cable, found herself in the course of a cyclone which passed directly over the vessel without causing her to lose her hold of the cable, and which was at once reported to the European continent, the report giving wind changes and velocity with barometric changes. It is also demonstrated by the light-ship off Frying Pan Shoals, N. C., which is anchored about twenty miles from shore, where it is exposed to the severe storms that occur off the Carolina coast. The value and importance of such stations is apparent; continuous observations could be had, not otherwise accessible; storms could be traced throughout their entire course, and the observations in connection with those of the signal stations on the Atlantic coast would decrease the danger arising from sudden storms.

The steamships of the great ocean lines and others could be warned by signal of storm raging across their path; communication by means of signals could be held with vessels, and vessels reported to owners; proximity of icebergs and wrecks reported—and it might be the means of saving many lives. If but one life was saved it would compensate for the expense of establishing and maintaining stations. These stations, under control of chief signal officers of the army and manned by observers of the Signal Service, would add valuable data to the science of meteorology.

NEW RIVER INLET, N. C., Jan. 25. F. S. COBURN.

SIMULTANEOUS OBSERVATIONS OF ATMOSPHERIC ELECTRICITY.

Somewhere in the Journal of the Japan Seismological Society, Prof. Milne indulges in a hope that before long a black ball hoisted on a mast will indicate to the people of Japan the expected coming of an earthquake, just as our storm and cold wave signals give to the people of this country their respective warnings.

As thunder storms are among the most destructive of atmospheric disturbances, and of such frequency in some parts of our country that the need and value of some system of signals giving warning of their approach is as great as in the case of earth movements, those of us who are interested in the workings of atmospheric electricity cannot afford to be less hopeful than the seismologist, of seeing such a system of signals in actual operation.

Our knowledge of atmospheric electricity, at present, is aggravatingly vague and useless for practical purposes. Our conceptions of certain physical properties, which we call potential, force, density, etc., give no tangible basis on which to work; and the relations existing between them are too involved, and often indeterminate, to allow of practical application. We are thus balked at the very outset, by the indefiniteness of the terms employed, and by our dependence upon quantities which, in the nature of things, cannot be determined. Most of the measurements made concern themselves with potential, or rather the difference of the potentials of given bodies; the potential of the ground, for example, being one, and the potential of the air at a certain point sufficiently distant from matter in conducting connection with the ground. Almost all our electroscopes and electrometers serve only this purpose—to indicate differences of potential;—and for the study of atmospheric potentials, the ground potential is generally considered for convenience as the zero. It is in dealing with the other component—the potential of the air—that we begin to meet with uncertainties. The water dropping arrangements and match burning devices, are the means employed to give us this potential. In theory their action is to help equalize the potentials of the air and of some conducting point, connected with the electrometer but carefully insulated from all other objects What, in fact, this action really is, remains doubtful. In the case of smoke particles from a

burning match, the particles are themselves electrified, while in the case of the water drops it is certain any alteration of the superficial tension must result likewise in an electrification of the drop. There are also many other circumstances in observations based on potential changes, that seem to make this method uncertain as well as difficult.

We turn, then, to observations based on measurements of the electrical density, that is, on the quantity of electricity per unit of surface. Such observations have been made, but singularly enough —for they are the more direct—have not acquired the prominence of those based on potential differences. Peltier, Quetelet and Dellman all employed this second method. Here, some portion of the earth's surface is removed, and the density of the charge on it measured. Induction and loss by dissipation, in the act of moving the carrier surface, make an exact determination difficult. Still, skillful hands and a little ingenuity should succeed in overcoming the difficulty. That this method has not attained the prominence of the other, is due probably to the great superiority of Sir William Thomson's electrometers over all other forms of instruments for electrometric purposes.

Theoretically it is quite possible to unite the two methods, and, if needs be, employ both at the same time to verify one another, though in actual practice this arrangement has never been tried, nor, to the writer's knowledge, even been suggested.

We have seen, then, the nature of some of the difficulties in the way of our obtaining a better knowledge of the electrical condition of the atmosphere. There are still other difficulties, practical ones, which however can probably be overcome. First of these is the want of proper instruments. The many forms of Sir William Thomson's electrometers are admirable enough, but they can only be used, to the best advantage, in a well appointed laboratory, and in the hands of those who have the time and knowledge required for their manipulation. For a series of simultaneous observations at different localities, and it is from such a series that we expect to accomplish most, we need more convenient and less sensitive, as well as expensive instruments. Some form of electrometer that shall be portable and convenient, and as easily read as the barometer, giving always for the same difference of potential the same indication, remains yet to be devised. The Portable Electrometer of Thomson is the nearest approach to such an instrument, and in the absence of a better form could be used with advantage.

Single, isolated observations go for little. We need a number of similarly made instruments, similarly manipulated, at the same moment of time, to get results at all comparable, at all profitable. The individual peculiarities of the instruments we need care nothing for, as it would be from their united evidence that the more general laws, by which we are to profit, would be obtained. It would be anew the story of the progress which meteorology made with the introduction of simultaneous observations over a large extent of country. Our knowledge is wanted for practical ends, and such a method is most likely to serve such ends. We should think of Beccaria, a century ago, studying incessantly the condition of the sky and the indications of his electroscope—so devoted to his pursuit that he slept and ate in the same room in which his electroscope was. From his time to the present many others have, in turn, with almost equal zeal and constancy observed and recorded with exactly the same result, so far as any practical benefit to us is concerned, as if, instead, they had occupied themselves with single isolated observations of temperature or pressure.

CAMBRIDGE, MASS. ALEX. MCADIE.

THE THERMAL BELTS AND COLD ISLAND OF SOUTHEASTERN MICHIGAN.

For many years the dwellers along the eastern shore of Lake Michigan were wont to speak of that locality as "the peach belt of Michigan." They, in common with the rest of the inhabitants of the State, believed that that was the only region of our peninsula where peaches could successfully be produced. Of late, however, the fruit growers of southeastern Michigan have discovered and proclaimed that they, too, have a peach belt; which is equivalent to saying that in that part of the State there is a thermal belt,—by which we mean a narrow strip of country not subject to such extremes of cold as that which surrounds it.

Let us examine a few facts and see to what conclusions they will lead us. Fruit buds are good thermometers for indicating a certain degree of cold, for they are sure to die when the mercury falls below certain points. Where peaches and other delicate fruits can be raised, it is evident that the climate must be milder than where they cannot. It is also a well known fact that on elevated grounds peach buds will survive the cold of winter much better than they

will on low lands, thereby indicating that highlands, for some reason, are warmer than those below. The people of southeastern Michigan have a range of highlands on which they can raise peaches, while those living in the lower parts of the State cannot. Therefore, the former must have a thermal belt. Let us see.

For the purposes of the following discussion we will lay down the generally received proposition that warm air is lighter than cold air; the former, therefore, continually seeks higher, while the latter seeks lower levels. In consequence of the facts expressed in this proposition, moderately elevated regions, with good outlets for the heavier cold air, are necessarily warmer than the regions below them. This proposition is known to fruit growers under the name of air drainage. We will now give some space to the consideration of the topography of southeastern Michigan, and see what relation exists between that and the thermal conditions of that portion of the State.

Commencing in Huron county, and running in a southwesterly direction through the counties of Sanilac, Lapeer, Oakland, Livingston, Washtenaw, and on to Hillsdale, is a belt of elevated country ranging in height from fifty to six hundred feet above the lakes surrounding the State. This elevation, instead of being a single range of hills, as it has heretofore been described, is, throughout a large part of its length, a table-land, at some points rising very abruptly to the height of sixty or seventy feet, and then by less precipitous gradations until the summit is reached. This table-land is a platform out from which isolated hills of considerable extent rise abruptly to heights varying from fifty to one hundred and fifty feet. Running longitudinally and centrally through this elevated country is a great valley, which divides it into *two parts* or *ranges*, which are parallel with each other. This valley and these two ranges are of great topographic and meteorological interest. Within that portion of the valley which lies in Oakland county are to be found nearly four hundred lakes, varying in length from a few rods to three miles. The ranges form the watersheds between several interesting river systems, viz: the system which empties into the Saginaw river from the east. Each one of this system takes its rise near the summit of the most westerly range. The system which empties into the Huron and Clinton rivers, and the system which empties directly into the great lakes and rivers on the easterly side of the State. From the lakes in Oakland county the two considerable rivers, Clinton and Huron, take their rise, the watershed

between them having but a slight elevation, and their distance apart at the nearest approach does not exceed one and a-half miles. There they spread out each into a lake—Union and Cass.

From Union Lake the Huron runs in a southwesterly course to Base Lake, which lies partly in each of the counties of Livingston and Washtenaw. From this point it bears to a southeasterly course and empties into Lake Erie.

From Cass Lake the Clinton runs in a general easterly direction to Lake St. Clair, thus making the division of the great highland as above mentioned. Because of the low watershed between them, the two rivers may be considered as having one common valley in the vicinity of their headwaters. Here the valley is several miles wide. At some points the valley of each river proper does not exceed from $\frac{1}{4}$ to $\frac{1}{2}$ mile. At such places are high bluffs on either side as at Rochester and Ann Arbor.

The slopes of these highlands are frequently divided by the small tributaries of the various rivers into high spurs, varying in length from three to five miles. The valleys between the spurs are generally quite deep, in many cases one hundred feet or more.

We are now ready to consider the climatology of southeastern Michigan in reference to its topography, and to determine the influence which the latter has on the former.

A glance at Dr. Winchells chart of isotherms of Michigan, for January, will reveal the following facts, viz: the isotherms for southeastern Michigan run in a northeasterly and southwesterly direction; that they are nearly parallel; that each one differs in average temperature from its consecutive on either side by one degree, in one case alone by two degrees; that the line of lowest temperature is in the middle of the belt of isothermal parallels; that some of the lines on either side of this line of lowest temperature run entirely around the latter and return upon themselves, thereby revealing a central cold island within two equal thermal belts enclosing it.

I believe that the credit for the original discovery of this cold island is entirely due to Dr. Winchell.

He makes mention of its existence, and says it does not lie upon the summit of the highlands, but he does not give its exact locality. It does not lie upon the summit and should not, as I shall hereafter show.

Still further study of the isothermal chart will show us that this belt of parallel isotherms corresponds in locality and direction

exactly with the high country above described; that the two belts on either side of the cold island are analagous in temperature and extent, and that those lines which do not return upon themselves after bearing southwesterly through Ohio and Indiana make their return to the great fruit region along the eastern shore of Lake Michigan; thereby showing that we have a winter temperature corresponding with that of localities two or three degrees to the southward and with that of the great fruit belt.

The writers own observations, the traditions of the inhabitants of this locality and the theory of *air drainage*, as expressed in our proposition above, all point to the fact that the cold island is situated entirely within the valley which divides the great highlands into two parallel ranges, and the thermal belts which enclose it lie upon the tops and scopes of the two ranges.

This is necessarily so and for the following reasons:—

As the air in the valley becomes warmed by radiation from the earth or any other cause, it becomes rarefied and consequently lighter and rises to higher levels. The colder air settles down to take its place, thereby causing the difference of temperature between the high and low lands. I do not believe it possible for a cold island to exist when there is not land enclosed by land still higher. In corroboration of this theory of a cold island, I will mention the following facts which are matters of tradition among the more observing people of this region. The same varieties of fruit, such as strawberries, raspberries and peaches are more apt to be killed by the cold of winter and late spring frosts in the valley than they are on the highlands. Vegetation starts earlier on the highlands than it does in the valley. During the summer of 1884, Cuthbert raspberries grown upon the highlands ripened, and were sent to market one week earlier than those which were grown in the valley. Corn and other crops subject to injury from the frosts of autumn can safely stand from two to three weeks later on the highlands than they can in the lowlands. This is a fact of general notoriety. At night, during warm weather, cold currents of air are encountered when one passes from the high to the lowlands. During the late frosts of May 1884, the cherry, grape and apple crops were uninjured in the high country, while the reverse was the case in the low.

It is also a matter of general notoriety in the high country that during very cold weather, the mercury never falls so low as it does in the interior of the state; the difference amounting to from five to ten degrees. There is a difference from three to five degrees

between the temperature of the cold island and the thermal belts on either side during very cold weather. It is worthy of note that the part of the state under consideration, does not generally have nearly the amount of snowfall that other parts do and that it is exempt from tornadoes, none having occurred within the memory of the oldest inhabitants.

In conclusion it may be said that this is a very remarkable region of country when it is considered in reference to its climatology, its topography, and the influence of the latter over the former; and also in reference to its lakes and rivers, whose waters are clear and pure. It is destined in time to become one of the greatest fruit regions in the land. It produced the largest portion of the apple crop of Michigan for the year 1884.

S. ALEXANDER.

BIRMINGHAM, MICH., Feb. 1st., 1885.

THE THUNDER-SQUALL OF JULY 5, 1884, IN KENTUCKY.

Mr. S. P. Ferguson of Riddleton, Tenn,. reading my statement in the Nov. Journal, that I was unable to obtain any reports concerning the squall of July 5, from Kentucky, wrote me that the squall was very severe in Kentucky, as shown by a number of newspaper reports which were collected by him and forwarded to the "Tennessee State Weather Service." These reports seem, however, to have been misplaced or lost, and I was unable to obtain them. In a subsequent letter, Mr. Ferguson wrote:—"The newspaper extracts that were sent with my July report, were taken from the *Louisville Courier Journal*, *Semi-weekly Post*, and other papers of a date immediately succeeding the 7th of July, embracing reports from correspondents in southern and western Kentucky.

"The Hickman, Ky. report gives the time of its presence and continuance, also the destruction of a church and loss of two lives. The report from Todd county, as well as now recollected, gives the time of occurrence and killing of five persons in one building, also the destruction of forty buildings (mostly barns and outhouses), besides immense damage in adjoining counties. From all sources of information, the total fatal casualties were some twelve or thirteen persons killed, and immense damage to crops, barns, houses and forests."

Upon the reception of these letters, I endeavored to obtain the papers mentioned, as well as a number of others published in Ken-

tucky and northern Tennessee. I only succeeded, however, in obtaining one paper from Kentucky,—the *Kentucky New Era*, of date of July 11, edited by James R. Wood, of Hopkinsville.

The account of the storm obtained from this paper is given in full below.

"A destructive storm swept through portions of Logan, Todd, and Christian counties last Saturday afternoon. No damage was done in Hopkinsville beyond breaking down and uprooting a number of shade trees. In various portions of this county many fences were blown down, wheat shocks scattered and the growing corn beaten to the earth by the wind and rain. At Pembroke the roof of a depot was blown off and several small frame houses were blown down. The storm was particularly destructive between Pembroke and Fairview, twenty-five or thirty barns having been blown down, a vast quantity of valuable timber utterly ruined, miles of fencing destroyed and several horses and mules killed. The storm was more violent at Trenton, Todd Co., and several miles around there than at any other point, as will be seen from the following special despatch to the Louisville *Courier Journal:* "The cyclone passed over this place about five o'clock in the evening, and continued to blow a hurricane for seventeen minutes, demolishing business houses, unroofing residences, and doing great damage to corn and wheat. The wind came from northwest, clouds were dark green, and the air was black with flying timbers. All the large timber was blown down in Trenton. The storm struck the dry goods store of McElwane Bros., leaving nothing but a pile of brick. Part of the building fell on J. D. Glasscock's house and crushed it to the earth, burying a large stock of saddlery, harness etc. Another part fell on J. C. Depen's restaurant and fancy green grocery, and J. W. Tutt's saloon and pool room, injuring building and stock greatly. Every one escaped from the building, and no one was hurt."

"On the farm of Col. W. P. Cannon, four miles northwest, a cabin was blown down, killing a negro woman and three children aged fourteen, twelve and one years. No further loss of life is reported up to this time. Reports are slowly coming in of damaged and blown down barns, cabins and fences. The damages cannot be estimated.

The loss here is; McElwane & Bros., $5,000.

"J. C. Dycus, $4,000.

"Bed Spring Company, $500.

"J. W. Tutt, $200.

"J. L. Glasscock, $200.

"P. H. Smith, $300.

"J. L. Cross, damage to farm property, $500.

"Number of barns blown down about one hundred." In addition to the above we learn that a number of other buildings were unroofed and chimneys blown down at that point. In the vicinity of Allensville the corn was blown down flat, the wheat shocks scattered much fencing laid to the ground, and many trees blown down. In the vicinity of Olmstead, Logan county, there were ten or twelve barns blown down, several mules killed, and great damage done to fencing, wheat in the shock, corn and oats. In fact there was a great deal of damage done to crops, fencing and timber along the track of the storm, and reports indicate that it swept over a large extent of territory. It was the severest storm that we have ever seen in this section, or anywhere else."

The proprietors of the Bowling Green *Gazette*, wrote me that the storm did not extend as far north as that place.

I received several papers from northern Tennessee, containing accounts of the storm which showed that the damage to corn, oats, fruit, fences, housetops, timber and outhouses in this section was very great. The *Smith County Record*, states that one man "jocularly remarked, that the only part of his crop not blown down was his sweet potatoes."

Mr. J. E. Gore, of Gainesboro, wrote me:—"The wind blew violently for only a few minutes. It did not seem regular in its course, but twisted and dashed around in different directions, especially among the hills, *always blowing down hill* (italics mine), as the corn, which, in many neighborhoods was flattened to the ground, attested. The general course, however, was from the northwest. Some timber was destroyed, but not a great amount; and a few houses of an insignificant character were unroofed."

It will be seen from these accounts that the squall reached its greatest violence in its extreme northern portion. This was also the case in the German squall of Aug. 9, '81, and the query arises —is this a characteristic of squalls?

Mr. Ferguson also sent me a brief account of a severe local storm of the nature of a tornado, which passed over some of the northern counties of Tennessee, about 3 A. M., Oct. 29, 1883. About seven persons were killed in the border counties of Kentucky. The track was about $\frac{3}{4}$ mile wide, and in places, where the contour of hills and valleys permitted, its reuniting on level ground was undulatory at intervals of $\frac{1}{4}$ to $\frac{1}{2}$ mile.

H. H. CLAYTON, JR.

EDWARD ISRAEL.

The subject of this sketch was a man of unusual character who, had he not been cut off at the early age of 25, would undoubtedly have left a decided impress on the world. As a martyr to the scientific investigation of the polar region—and withal a martyr of remarkable promise—some notes on his life are not without interest. He was born at Kalamazoo in Michigan July 1, 1859. He was of German parentage, and was so accustomed from his earliest childhood to the use of German that it was as readily at his command as English.

From his earliest childhood he showed a modesty and unselfishness, an affectionate kindness toward all, that made him the favorite in school as well as in his own family. Although so greatly beloved in his family that he might have easily become a spoiled child, he never took the slightest advantage of parental partiality, but was even plainer, more frugal, and more easily satisfied than the rest of the children. A peculiarly attractive feature of his amiable character was his contentment and happiness under all circumstances. As a school-boy, he enjoyed with a certain zest and relish all the innocent little pleasures and sports which school life affords. Later, in Ann Arbor, amongst strangers and missing many of the comforts to which he was accustomed, he was so thoroughly happy, that he often said that there was not a day that he would not like to live over again. He was a true friend, intense and constant.

We cite a few remarks from a letter of his intimate friend, Dr. Kirkland, to show that the friendship he inspired was not that too common kind, originating with school-life and terminating at its close. "I loved Ed. He had qualities which make men noble. He inspired respect as well as love. For no man whom I ever knew, did I entertain the same feelings that I did toward him. I knew him intimately, and I never knew him to commit an unmanly or ignoble act. He was a truly manly man. I would have trusted him with my soul. He would not have lived without making his fellows better,—happier. It is strange that he should be taken from us. We can only consider him a martyr to science."

No outward circumstance, ever so void of ease or comfort, could lessen his inward happiness. In his letter from Fort Conger, to his

mother, he says; "I am in harmony with God's whole creation, and, being so situated that I can be useful to mankind, I would be perfectly happy but for the uneasiness of my mother about me." He made not a word of complaint even to the last. When death came with the additional terrors of cold, desolation, starvation which belonged to his situation, he wrote in a farewell note to his mother;—"Our winter's experiences here were not nearly so terrible an ordeal as it must appear to you;" and his mother writes of him "He had the most thoughtful and loving disposition, forgetting himself in his love and solicitude for others."

After having completed his school-course at home with great distinction, he came to the University at Ann Arbor, in the autumn of 1877. He was one of the youngest of his class, but easily stood near or at its head. His predilections were decidedly for mathematical studies, and the writer of this sketch well remembers the difficulty which he seemed to have in understanding which was the hard and which the easy part of his tasks. He read with me Watson's Theoretical Astronomy, a work so advanced as to be beyond the range of most college students, and even to offer in places serious difficulties to the professional mathematician or astronomer. Mr. Israel not only read the entire book in a half year, but he seemed entirely unconscious that he was doing anything extraordinary. I was particularly struck by the fact that he never knew that in his usual forty pages he had passed over something especially hard, unless I informed him of the fact. Our daily meetings, for he made so much more progress than his one or two fellow members of the class that I met him alone, soon changed from recitation to discussion of topics suggested by what he had read, and these discussions would have been more animated had it not been for his modesty and reserve.

A few weeks before his graduation, there came the opportunity for me to nominate an astronomer for the expedition to Lady Franklin Bay. The nomination was offered to Israel, with some hesitation. This was caused not by any doubt as to his ability to do the work, but by a partial knowledge of his domestic circumstances. He was idolized by a widowed mother to whom even the proposal to have him join a polar expedition would be painful. His circumstances in life were so easy that he could pursue, without anxiety as to income, any line of study which he might select. On consulting with him, the only motive which restrained him from accepting the nomination at once was a knowledge of the pain it would give his mother. With rare self-denial she encouraged him

to do what he thought best, and he accepted the nomination, which was soon followed by his appointment. He left Ann Arbor in April of his senior year, and in consideration of his unusual merit, was given his degree in his absence.

As to his relations to the party and the work done by him, we make the following quotations from a letter from Lieut. Greeley to Mrs. Israel, dated August 16, 1884: "It was owing to his careful astronomical observations, made under the most trying circumstances, that the time-observations connected with the pendulum-work, were successful. The pendulum observations, which, in the case of the English expedition of 1875–76, entirely failed, were in our case successfully made. These observations are said to be of the most valuable character, and your son will be credited therewith. In like manner I put him in charge of the magnetic work for which he will also receive credit."

"Your son, during the past terrible year, occupied the same sleeping-bag with me. He was a great comfort and consolation to me during the long weary winter and spring, until his death. To you, who know his gentle character and amiable disposition, it is hardly needful to state what impression he made on my affections. He was warmly loved by all the men, and I readily believe he spoke the truth when he told me he was certain that he had not an enemy in the world."

Lieut. Greeley goes on to relate that at the time of his death, he did not forget those around him nor his friends at home. Having some money on his person, he requested that a small sum should be given to the family of each of the two Esquimaux of the party who had already perished. He also requested that a sufficient sum be reserved with which some survivor might visit his mother. The balance of the money, he desired, should be spent in purchasing delicacies for his surviving comrades while *en route* for home, and that the expenditures should be exceptionally lavish in the case of Corporal Elison, who had lost both hands and both feet. Lieut. Greeley adds that he preferred to do this at his own expense, thus fulfilling an unique will, perhaps as remarkable and as admirable a one as the world ever saw for delicacy and thoughtfulness. To understand the character which dictated last wishes of such a nature, we must remember the circumstances under which he was placed, the desolation surrounding him, the natural ferment and souring of men's relations to each other when shut up together away from the rest of the world for year after year, the hardships of death from lack of nourishment and far away from kindred,

when it was fairly certain that the survival of a few days would bring relief and life; under all these circumstances nothing but a character, a nobility of mind, and a philosophy which the world rarely sees, could have formed and expressed such last wishes.

Israel died on May 27, only 26 days before the rescue. He met his death with great firmness and resignation, regretting it only on his mother's account. His death was painless and easy, resulting from water around the heart, caused, of course, by insufficient nutrition. "His remarkable mental powers caused him to live 'till among the last," says Lieut. Greeley, "despite the fact that he was physically the weakest man of the party." His remains were received at Kalamazoo with a great popular demonstration, and his funeral was attended by the common council and mayor of his native city in their official capacity.

We will make a single quotation from his letter from St. Johns to his mother, written on June 29, 1881, immediately before he sailed for Greenland. He says: "I was greatly surprised to-day on examining our supplies; there is nothing which could possibly be carried of which we have not a great abundance. As far as safety and comfort are concerned, no expedition was ever as well equipped as ours."

M. W. HARRINGTON.

THUNDER STORMS.

Observations on thunder storms, made by an observer who rises right into the midst of the warring elements, must necessarily be interesting and valuable to students of thunder storms. Such observations are, unfortunately, rare; and the following letter by Jno. Wise, giving an account of some observations on thunder storms from the car of his balloon, though written as far back as 1857 and much discussed at the time, will no doubt prove both new and interesting to a large number of the readers of THE JOURNAL:

"*To the Editor of the New York Tribune:*

SIR:—A great deal has been written about storms—much from theoretical deductions, and some from facts. My purpose in this treatise is to relate the physical aspect of thunder storms as viewed from above the clouds, from the surface of the earth, from their sides in mid-air, and from the middle of their cauldrons. I have made diligent observations on these meteors for ten years past, and have read some theories concerning them: but as my object is mainly to give facts to the student of meteorology, I will confine my relation at present to that which developed itself to the senses of seeing, hearing, feeling and smelling of these phenomena.

A storm viewed above the clouds has the appearance of ebullition. The upper surface of the cloud is bulged upward and outward, and has the resemblance of a vast sea of snow boiling and upheaving from internal convulsion. The view is

from a point where the atmosphere is clear around and above. Immediately above the storm the air is not so cold as in a place where there is no cloud nor storm beneath. The falling of the rain can be heard above the cloud, making a noise like a waterfall over a precipice. The thunder heard above the cloud is not loud, and the flashes of lightning appear like streaks of intensely white fire on a surface of white vapor. A side view of a storm, viewed when it is a mile or two off, and somewhat lower than the point of observation, presents in form the shape of an hour glass; the picture of a waterspout also gives a good outline of its shape. In this well defined form it moves along over the earth. When the storm is so small that you can embrace its whole bulk at a single glance—which you can do when several miles off and a little more elevated than the meteor—it looks as though it were trailing its lower base along on the surface of the earth, and has an individuality which cannot be recognized when viewed from the ground. Although the storm is being moved along by the same current of wind that is drifting along the observer, it will be deflected from that course by its encountering a mountain ridge, or deep valley, just in proportion to the amount of lateral force or obstruction it sustains in each case; and then the observer in a balloon may continue onward, while the storm may be moving off at right angles to his route. These lateral views of storms are very grand and imposing as they rush along by an elevated observer. A grand army of flying artillery at full gallop, in all the panoply of war, could not produce so imposing a sight; over city, forest, river and plain it goes with undaunted march.

A closer view from the side of a storm, and partly in it, reveals a very interesting physical aspect. The one now described occurred on the 3rd of June, 1852, during a balloon excursion from Portsmouth, Ohio. The storm was kedging up the Ohio river, about fifty miles above Portsmouth, and where the river courses nearly north and south, while I was sailing from west and east. Moving at right angles with the storm soon brought us together, and the country below being dense forest, the meteor's company was preferred to a reception in the woods. It was easy to keep out of the vortex of the storm, from an abundant supply of ballast aboard of the air-ship, hence a point in its wake was the station of observing its action; and having learned that the shape of storms was like two cones with ends joined, with a wind driving in below and rushing out again at its top, you might sail with impunity in its wake, provided you kept midway between the upper and lower clouds. When getting too low in its wake there was a tendency to rock the balloon into the vortex, but this was countervailed by going up near the out-spreading cloud. In this position the air is cold, and you are in the shadow of the upper cloud, unless you sink low enough where the sun may reach you under the over-lapping cloud. Although the sun was shining on me, the rain and small hail were rattling on the balloon. A rainbow was standing in and against the body of the meteor, or rather a prismatically colored arch the shape of a horse shoe was reflected against it, and as the point of observation changed laterally and perpendicularly, the perspective of this golden grotto changed its hues and forms. Above and behind this arch there was going on the most terrific thunder, but no zig-zag lightning was perceptible, only bright flashes like the explosions of Roman candles in fireworks. Occasionally there would be a zig-zag explosion in the cloud immediately below, and the thunder therefrom sounded like a '*feu de joie*' of a rifle corps. Once an orange colored wave of light seemed to fall from the upper to the lower cloud, and right over the balloon, but no sensible effect was produced by its contact. This was 'still lightning.' There appeared all the time while in the storm electrical action going on in the balloon,

such as expansion, tremulous tension, attraction by lifting papers out of the car ten feet below the balloon, and hugging them to its body for a moment and then letting them drop off again; but as I had no instruments, I can only relate the manifestations of electricity in this case. While, as I stated above, a distant view of thunder storms is imposing and grand, a closer view of a great storm, such as this Ohio meteor, is truly sublime, although the rushing noise below and in its midst, like the tumult of a thousand chariots of war, is almost appalling.

The quantity and quality of thunder seems to be in proportion to the magnitude of the storm. A storm may be so limited in size that there will be no electrical explosions. In this case the developed electricity can be dissipated and taken up by the immediately surrounding cloud formation. April and May showers are an exemplification of this fact. When the storm is of great magnitude, the central portion of its top becomes surcharged with electricity, because the surrounding cloud-formed vapor cannot conduct away it silently as fast as it is developed, and hence explosions must ensue such as noticed in the Ohio meteor, with terrific and rapid discharges of thunder; and, moreover, the drops of rain that are formed from this surcharged vapor of the upper cloud also becomes redundantly electrified, and although they fall quietly down through the intervening air, which is a non-conductor, as soon as they reach the lower cloud, which is negatively electrified, they give up their surplus, silently if the capacity of this cloud is sufficient to take it up, but explosively if the capacity of the cloud is insufficient; and it may fall off laterally until dissipated, or it may glance downward to the earth, rending whatever it encounters before its diffusion in the earth. The physical facts here stated are as I saw them; the rationale of explosion is confirmed from the known play of electricity as divulged by the common electrical machine experiments.

A storm viewed from within its cauldron—that is, from within its vortex, where the cloud vapor is driving upward to where it spreads out—is rather a terrible thing; and the very fact that you are caught up in the midst of one of nature's laboratory furnaces makes you feel resigned, and determined to look to the end thereof. It may be only terrible because we are not used to it; nevertheless, I would not like to enter one again for observation until science dictates without a doubt, that we are not liable to annihilation or serious harm. The one now to be described is the result of a trip in the midst of a local storm of so limited dimensions as to have no electrical explosions during my passage of nineteen minutes within its bosom. This storm originated over the town of Carlisle, Pennsylvania, on the 17th of June, 1843. I entered it just as it was forming. The nucleus cloud above was just spreading out as I entered the vortex unsuspectingly. I was hurled into it so quick that I had no opportunity of viewing its surroundings outside, and must, therefore, confine this relation to its internal action. On entering it the motion of the air swung the balloon to and fro, as also around in a circle, and a dismal, howling noise accompanied this unpleasant and sickening motion; and in a few minutes thereafter was heard the falling of heavy rain below, resembling in sound a cataract. The color of the cloud, internally, was of a milky hue, somewhat like a dense body of steam in the open air, and the cold was so sharp that my beard became bushy with hoar-frost. As there were no electrical explosions in this storm during my incarceration, it might have been borne comfortably enough but for the sea sickness occasioned by the agitated air-storm. Still, I could hear and see, and even smell, everything close by and around. Little pellets of snow (with an icy nucleus when broken), were pattering profusely around me in promiscuous and confused disorder, and slight blasts

of wind seemed occasionally to penetrate this cloud laterally, notwithstanding there was an up-moving column of wind all the while. This up-moving stream would carry the balloon up to a point in the upper cloud, where its force was expended by the out-spreading of its vapor, whence the balloon would be thrown outward, fall down some distance, then be drawn into the vortex again to be carried upward to perform the same revolution, until I had gone through the cold furnace seven or eight times; and all this time the smell of sulphur, or what is now termed ozone, was perceptible, and I was sweating profusely from some cause unknown to me, unless it was from undue excitement. The last time of descent in this cloud brought the balloon through its base, where, instead of pellets of snow there was encountered a drenching rain, with which I came down into a clear field and the storm passed on. This storm may have been accompanied with electrical discharges after it left me, as it had the appearance of increase as it departed. I may mention that the people in the neighborhood informed me next day that it deposited two parallel trains of hail some distance apart. I have frequently since and before this occurrence witnessed storms while up in the air, but a great distance off, sometimes four or five of them at the same time in different parts of the heavens, and always in the months of May and June, and never accompanied with electrical explosions when they were small in dimensions.

Thunder storms viewed from the earth have not the characteristic shapes lineated to the eye of the observer as when viewed sideways from above; neither does one discover the two plates of clouds joined in conic sections. The upper cloud can be seen rolling outward, and black clouds below entering inward, but the whole seems to be nearly blended in one solid mass. By close observation and practice it will be deduced that there are two plates of clouds, even as viewed from the earth. In watching clouds carefully from the earth, it will be observed that vivid zig-zag flashes and heavy peals are followed by copious showers. The rain drops, being positive charged from the upper cloud, drop through a clear atmosphere, which is a non-conductor, into the lower cloud, which is negatively electrified; and if the shower is too copious for the lower clouds' capacity to absorb it silently, explosions must follow, in the same way as a Leyden jar explodes spontaneously when charged to overflowing. Were it not for the lower cloud and its negative condition, the surcharged drops of rain would scintillate their electrical fire as they touched the earth.

Thunder storms rage more violently as they pass over forests and moist places, and were it not for the deposit of rain as they pass along, their track would exhibit a parched trail. A long drought is adverse to the generation of a thunder storm, and on the other hand a moist earth is productive of one.

Thunder storms are deflected from their courses, as well as retarded in their movements, by friction on the earth. Ascending from the earth with a balloon in the rear of the storm, and mounting up a thousand feet above it, the balloon will soon outride the storm, and may descend in advance of it. I have experienced this several times.

I have thus related facts which are due to science, with a view to a more accurate understanding of the laws that govern them; and in order to spread them broadcast before the investigating minds of the day in this department of science, I forward you this account, to be published in your widespreading journal should it meet your approbation to do so.

LANCASTER, PA., February, 1857. JOHN WISE."

METEOROLOGY OF THE MOUNTAINS AND PLAINS OF NORTH AMERICA,

As Affecting the Cattle-Growing Industries of the United States.*

Mr. President and Gentlemen of the Cattle Growers' Convention:

Congress by its laws regulating the sale of Public Lands, recognizes three classes or grades of lands, to each of which it has prescribed the maximum quantity that may be sold to the same person in any one locality, as follows, viz:

600 by 1,500 superficial feet of mineral lands; 160 acres of agricultural lands and 640 acres of barren or desert lands.

These have hitherto been thought to cover all the purposes for which the public lands would be required.

Since those laws have been enacted, however, and only within a few years past, another industry has been developed which requires the use of much larger areas of land to make it at all possible of economical and successful prosecution, and that is cattle-growing. But it so happens that the lands required for this industry are by no means the best for agriculture or mining, and are often, on the contrary, quite unfit for either of these purposes, but are known and characterized as the grazing or "Buffalo Plains" of the West; from the fact that they were infested by these and other herds of wild browsing animals, who preferred the scanty tufts of the wiry but succulent and nutritious grasses that were found upon these plains to the more rank and abundant growth of the surrounding regions. This untrained instinct of these wild herds is Nature's testimony of the special fitness of these plains for pastoral purposes; and we, as intelligent people, cannot do better than to follow Nature's promptings in the utilization of these lands.

These plains extend from Texas to Canada, about twelve hundred miles in length, and with a width eastwardly from the base of the Rocky Mountains of about 300 miles, making an area of 360,000 square miles, or upwards of 250,000,000 acres of land which, with rare and limited exceptions, are fit only for grazing, and can never be profitably used for any other purposes. The laws should, therefore, be amended by adding another or "pastoral" grade to the Public Lands Schedule, and with authority for leases alone to be made to persons wanting such lands in tracts of not less than 20,000 nor more than 30,000 acres to each lessee for terms of twenty years, which would prevent these lands being monopolized by a few persons to the detriment of others, and would yet give to the tenants security in those propriety rights necessary to prevent the trespassing by others, or disturbance from Government agents or officials.

As I have before intimated, these lands can never be converted into agricultural lands, notwithstanding the various schemes proposed from time to time for their irrigation and reclamation from agricultural sterility; for there are physical causes for that sterility which neither the power nor ingenuity of man can change, and as it has been thought that a brief discussion of these causes might not be uninteresting to the members of this Convention, I have been asked to give you my views in regard to them.

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*An address before the Cattle-Growers' convention, St. Louis, November 18th, 1884, communicated by the author.

To do this will, of course, involve a wider range of investigation than if the simple facts and conditions of the problem were accepted without going back to their origin or cause through the meteorological processes by which these facts and conditions are brought about.

I will first call your attention to this skeleton map of North America, where only the main ranges of mountains, chief lakes and principal rivers are laid down other details being omitted so as to prevent confusion.

The principal range of Mountains extending through Central America into Mexico is a continuation of the Andes of South America. In Mexico, however, these mountains are known as the "Sierra Madre" or "Mother Range," and which throws off two branches—one to the northwest along the Pacific coast, in California, where it is known as the "Sierra Nevada" or "Snow Range," and which runs thence up in to Oregon where, with a lower altitude to the range, it assumes the name of the "Cascade Mountains," and where it is broken into a number of detached, isolated but majestic peaks, such as Mounts Jefferson, Hood, Adams, Ranier, St. Helens, etc., etc., which stand as hoary sentinels surpliced in eternal snow to mark the gateways through which the moisture-laden winds from the Pacific ocean gain access to the heart of the continent.

The other and in many respects the grander branch from the Sierra Madre is the Rocky Mountain Range, which. running almost due north about the 110th and 120th meridians of longitude, until reaching the parallel of 45 degrees north latitude, where this range sinks to an elevated "divide" of from 6,000 to 8,000 feet above the level of the sea.

Lying between these ranges, and extending from the Sierra Madre to the Yellowstone Park, lies a plateau or plain of comparative sterility and barrenness, comprising much of the territories of Utah, Arizona, and Nevada.

With this preliminary description of the map, I shall now proceed to discuss some of the meteorological phenomena that have a direct bearing upon the question before us.

It is generally believed that the sun is the direct evaporator of humidity, and especially of the ocean waters, and that the evaporation from the oceans is mostly from the equatorial regions of the earth, and that the vapor from this evaporation is transported by the winds through the upper regions of the atmosphere directly North and South to its points of distribution in the temperate and frigid zones.

This, however, I think is a fallacy, and that in reality, notwithstanding the enormous evaporation that does undoubtedly take place in the equatorial regions, by far the greater part of that evaporation is precipated back to the earth's surface within the tropics, and that by quite a different process are the regions of the earth beyond the tropics, supplied with water from the heavens.

The sun's rays being more nearly vertical within the tropics, have so much the more heating power, and the surface waters of the oceans there are thus brought up to a general temperature of 88° F.; from whence this heated water is carried north and south, to the earth's extremities, by grand ocean streams which are the life-giving arteries of the oceanic and inter-oceanic circulation.

Of these streams there are four, the two grandest and greatest of which are thrown off to the southward, from the equatorial currents of the Pacific and Indian oceans; whilst the remaining two are thrown off northwardly from the tropics in the north Atlantic and Pacific oceans. The first of these latter is the Gulf Stream, whose general character is familiar to us all. The other is the Kuro-Siwo, of more recent discovery, which starts from the southeast coast of China,

and running northeastwardly with a velocity of from 30 to 80 miles a day, and losing only one degree of warmth for every 300 miles that it travels, washes the south coast of Japan, and spreading a mantle of tepid water of upwards of 70 degrees of temperature over the surface of the North Pacific, it envelopes the whole west coast of our continent from Behring's Straits to the equator with its genial warmth, and gives to that region the delicious climate which is now becoming so well known to us all.

Now, whilst the sun by its heat in the tropics has prepared these waters for rapid evaporation by giving to them their high temperature, yet the sun itself cannot and does not evaporate any portion of them, except through the medium of the atmosphere. And the power of the atmosphere to produce this evaporation is in exact proportion to its low temperature and its dryness as compared with the water at the time of its contact with these tepid waters from the equator.

The prevailing winds in the temperate zones are from the westward. The west winds which come to the North Pacific from the plains of Central Asia and Siberia are cold, contracted and dry, with a temperature frequently below the freezing point, so that when they reach the tepid waters of the Kuro-Siwo they at once respond to the warm and expanding influence of these tropical waters, and as they expand drink up by evaporation prodigious quantities of the latter, which as invisible vapor or fogs are borne eastwardly across the surface of the ocean to the west coast of our continent.

That portion of these winds that reach our coast about the mouth of the Columbia river are chilled by the Cascade mountains, and made to yield such quantities of rain as to have produced a forest growth of so rank and majestic as to be unrivalled by any other forests of North America; and just north of the Cascades come the open gateways through the mountain ranges guarded only by the detached and hoary peaks before named, between which these west winds carry their burdens of warmth and moisture to gladden and fatten the face of the interior or the continent, but which on their way pay such tribute to these majestic sentinels as to clothe and crown them in the purity of everlasting snow, and then reach the elevated region of the Yellow stone Park with still abundant moisture, which is dealt out from their hitherto invisible treasures with such royal profusion as to give birth to and keep in perennial flow the grandest systems of rivers on the face of the globe, viz: the Columbia, McKenzie, Saskatchawan, Assiniboine, Yellowstone, Missouri and Colorado, which radiating north, east, south and west from this immediate region, and, with courses of thousands of miles each, distribute their waters into all the oceans surrounding the continent. This may, therefore, be not inaptly called the "*Water Dome of North America!*"

Stretching eastwardly from this "dome" to the mouth of the St. Lawrence river on the Atlantic coast, lies a declining ridge, from which waters run north into Hudson's Bay, and south by the Mississippi, Illinois and Ohio rivers and their tributaries into the Gulf of Mexico, and east of the Alleghenies by the Potomac, Delaware, Hudson, Connecticut, and other rivers into the Atlantic Ocean.

Beside all these mighty rivers that have their geneses in the direct pathway of these west winds across the continent, and cradled upon the crest of the ridge just described, lie the great Lakes of Superior, Michigan, Huron, Erie and Ontario, which alone are estimated to contain one half of all the fresh water resting upon the face of the earth, and which, notwithstanding the necessarily enormous drain from them by evaporation, yet have always such a surplus of water as to keep in unvarying flow from them the majestic St. Lawrence River.

Now the waters which supply the rivers radiating from what I have termed the "water dome," all come from this west wind from the Pacific, as I believe do also those which supply the other rivers in the Mississippi basin west of the Allegheny mountains, together with those waters that fall into and make the great Lakes. Whether or not the waters that go into the rivers east of the Alleghenies come from the same source is doubtful. I think, however, that through local agencies, they come from the gulf stream of the Atlantic. Yet it is not unreasonable to believe and affirm that by reason of the waters that do come from the prevailing west winds from the Pacific that it is the *Kuro-Siwo of the Pacific that irrigates and fructifies the heart of the continent of North America.*

Now it may be asked, what has all this to do with the aridity of the alkaline plains of Colorado and New Mexico? Very much, as I shall endeavor to show, by first calling your attention again to the water supply that is carried under the wings of this west wind from the Pacific ocean and distributed nearly, if not quite across the continent (when not interrupted by the condensing power of intervening mountain ranges,) since that is the gauge by which the quantity of water carried by these winds can be measured; and if found in one portion of these winds, it is not unreasonable to believe that other portions carry a corresponding quantity. But let us now see what becomes of that supply from that portion of these winds which strike the land south of Oregon, and which, being slightly chilled by the coast range of mountains and hills, give out moisture enough to envelop the coast with fogs and clouds during many months of the year. Passing thence, into the interior, these winds are thrown upward against the cold flanks and peaks of the Sierra Nevada, where being condensed they crown the latter with their coronets of eternal snow. Descending the eastern slope of the Sierra Nevada range, these winds reach the plateau of Utah and Arizona before described, so robbed of moisture that the earth's sterility is but the evidence of its unslaked thirst.

Continuing eastwardly, these west winds then climb the western slopes of the Rocky Mountains, but without moisture enough in them to clothe with vegetation the rock-ribbed walls whose sombre and rugged nakedness attest the infrequency of rain upon them, Still the altitude of these mountains is so great, and therefore so cold that their supreme peaks wring from the shrinking winds what little moisture remains in them, to add sparkling coronets of snow also to their majestic heads. But these winds, pitching thence down the eastern slopes of the Rocky mountains, reach the plains of Colorado so completely dry as to be unable to give forth even a morning dew, and hence the alkaline sterility of these plains which no human intervention can change or alleviate.*

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*If this meteorological hypothesis is correct, then similar phenomena should be found on the other continents.

Let us see if that is the case.

The west winds which we have followed across North America, on leaving our eastern shores, are cold, compact and dry, but as soon as they reach the tepid waters of the Gulf Stream, they at once respond to their warming influence and rapidly expand, and in expanding take up by evaporation enormous quantities of water from the ocean, which they carry as invisible vapor or fog eastwardly across the Atlantic, to clothe the British Islands and Western Europe with their emerald robes of vegetation. Then that portion of them that are intercepted by the Alps is contracted so as to cap these mountains with perpetual snow, encircle them with profound lakes of marvelous beauty, and give birth to and feed the splendid system of rivers, which radiating from this "Water Dome" of Europe, discharge their waters into all

Now I hope it has been made apparent that these plains, as well as the plateau of Utah, Nevada and Arizona, owe their sterility to no accidental nor remedial cause, but to the immutable laws of Nature, which are not to be changed by man. That these lands, as they stand, and will forever stand, are not fit for agricultural cultivation, except in rare places along the water courses, but are specially fitted for grazing and cattle growing, and which in my judgment should as a whole, be set aside by the government for the encouragement of that indnstry alone, since the water courses and water privileges are imperatively required by the ranchman, and without which all the rest of the grazing plains are practically worthless. Nor is this a hardship to the farmer. For agriculture has had and is still having more lavish and unpaid for favors conferred upon it by the government than any other industry among our people; and the farmer should not complain if the laws are so modified—in justice to a great and valuable interest—as to require the farmer not to interfere with that interest by taking the kernel of the land for their own use, and leaving naught but the husks for herdsmen.

Is you ask wherein has agriculture been so favored by the government, I will say that ever since Mr. Jefferson began to attract immigration to this country by proclaiming to the world that we would give to agriculturists all the land they wanted in fee simple forever, upon the payment of the mere cost of survey, $1.25 per acre, while farmers in Europe are paying an annual ground rent of $20.00 per acre. Agriculture has been and is subsidized to the annual amount of not less than $18.75 per acre—less the cost of transportation of that acre's products to the competing markets of Europe.

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the surrounding seas. Among these latter may be named the Elbe, Rhine, Saonne, Seine, Rhone, Po, Adidge and Danube.

The more northerly portion of these winds, from the west, deflected somewhat by the Carpathian and Altai mountains, pass eastwardly across Northern Russia and Siberia, and carry in their wings the water that gives birth to feed the Obi, Yenissei, Lena, and other grand streams that empty into the Arctic ocean, and finally reach the Pacific, as the cold, dry winds first spoken of.

It may be said, therefore that the Gulf Stream of the Atlantic irrigates and fructifies the Continent of Europe and Northern Asia.

Southern Asia receives its humidity from the tepid waters of the Indian ocean, by means of the northeast and southwest monsoons, which prevail there.

Africa being a tropical continent, is traversed by the trade winds, which blow from the eastward. These winds saturated with moisture by evaporation from the hot waters of the great equatorial current that strikes the east coast of Africa, after its journey of 15000 miles, along the equator from the west coast of America, sustain the rank vegetation which belts this continent in the tropical region, from the Indian to the Atlantic ocean; crowns the mountains of the Moon, with the magnificent lakes of Albert and Victoria, Nyanza, Tanganika, and others and keep in perennial flow from this "water dome" of Africa the majestic Nile, Congo and other rivers radiating from thence to the surrouning seas.

The great equatorial current of the Pacific and Indian oceans, therefore, irrigates and fructifies the continent of Africa, through the agency of the trade winds.

In the same way is South America irrigated and fructified from the equatorial current of the Atlantic, by waters evaporated from it by the trade winds, from which their moisture is wrung by the cold flanks and yet colder summits of the Andes, from which flow into the Atlantic waters the Orinoco, the Amazon and the Rio de la Plata, with their myriad of tributaries; but when these winds have scaled the Andes, the extreme cold of the latter has so contracted and wrung from them all their moisture, that when they pitch down upon the west coast of Bolivia and Peru, they are as rainless as those arid winds which cause the alkaline plains of Colorado and New Mexico.

But not only that, agriculture is further subsidized by the hundreds of millions of dollars paid by the government for the building of railroads to open up and make these lands of easy access, and lessen the cost of transportation to and from. That the government has been subsidizing agriculture for nearly one hundred years; has paid out upwards of $150,000,000 in the purchase of lands from foreign powers in addition to those acquired by conquest, all of which have been and are being wisely bestowed in subsidies as encouragement to agriculture, and which subiidies have been the means of building up the population and wealth of the country as nothing else could have done.

It is nothing but right, therefore, that now, when a sister branch of industry asks to be protected from influences that must be fatal to its success—though that protection the exclusion of a comparatively few farmers from certain regions of the public domain that are better suited for that industry than for agriculture—the government and congress will, I am sure, grant that protection.

Agriculture has $13,000,000,000 already invested in its industries with thousands of millions of acres of land of the public domain still open and free to its occupancy outside of these grazing lands, which the cattle growers must have in undisturbed control.

It is not the purpose of this Convention to antagonize the agricultural, nor any other element of the community, against the industry you represent. But when an industry of the magnitude and rapidity of growth such as yours, wants recognition and protection from Congressional laws, so that those engaged in it may know what they have to look to and depend upon before putting more money into that industry, I think there need be no hesitancy on the part of the representatives of this Convention to appear before Congress and frankly and fully state their case, and ask its favorable consideration; for I feel sure an equally frank response will be accorded to their just demands; and no other, I am sure will be asked.

You don't ask the government to give you anything without fair compensation for the same; nor do you ask for any privileges superior to those given to other interests in the community.

Certain portions of the public domain are already set apart for mining, as others are set apart for agricultural cultivation, from which cattle grazing is excluded; not by the words of the law, it is true, but by the operations of that law which forbids those lands being sold in any other than such small lots and tracts as to entirely exclude from them cattle raising upon a scale at all profitable for beef supply to our people and those of Europe. Then, as a matter of justice let these certain regions or plains, which Nature intended for grazing grounds, and the most of which can be used for no other purpose, be set apart, as a whole, to be called "pastoral lands," which the government shall not alienate in fee simple to any one, but hold them open for leasing for terms of twenty years, in large tracts, and thus protect them from monopolies, and at the same time preserve them under control, for the use of the cattle growers and the beef makers for not only America but for the rest of the civilized world.

St. Louis, Mo. SILAS BENT.

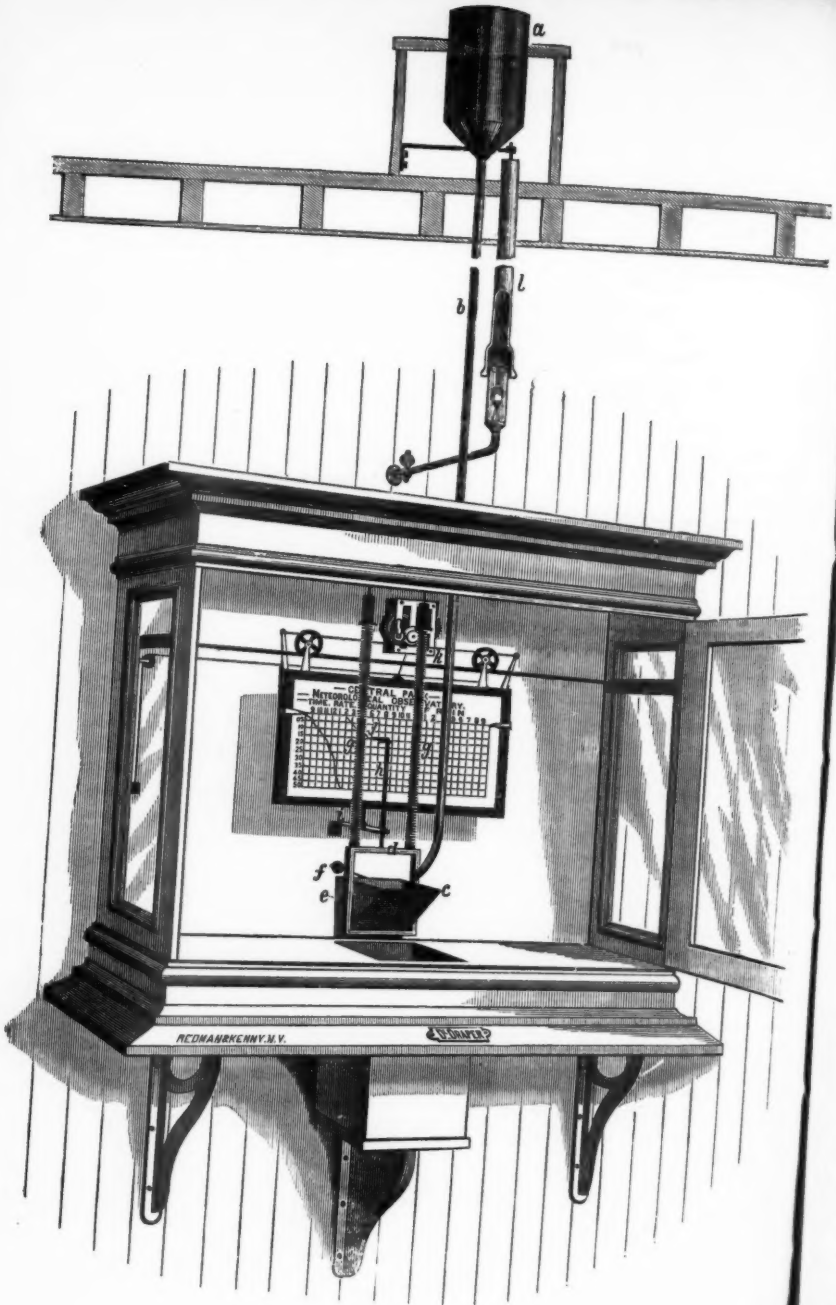
DR. DRAPERS' RAIN AND SNOW GAUGE.

The first rain-gauge constructed for the Observatory was on the principle of Tantalus' cup; that is, when the receiving vessel had collected a certain amount of water, it emptied itself into another by means of a glass siphon, and returned to the top of the register to receive a new supply. But sometimes it happened that small insects or pieces of leaves, etc., would choke the siphon, retarding or stopping it it from emptying the receiver. This led me to the construction of another, on the principle of a gravity bucket; that is, after a certain amount of water has been received in the bucket, it tilts so as to empty all the water out, and after doing this returns to its former position. This gauge multiplies ten times, so that rain-falls of one-hundredth of an inch may easily be measured.

DESCRIPTION OF INSTRUMENT.

About two feet above the roof of the buildidg is placed the usual circular rain-gauge receiver, marked *a;* it is eight inches in diameter, funuel-shaped at the bottom, and leads into a block-tin pipe, *b*, three-eights of an inch in diameter. This gauge is mounted on a square box that will be described below. The pipe descends from the gauge tothe receiving or gravity bucket, *c*, which is made of brass and is of a triangular prismatic shape, balanced just above and forward of its center of gravity in a square frame, *d*. by two pivots, one of them marked *e*. These allow it to tilt when the water has reached a certain height or quantity. The leaden weight, *f*, is an adjustable counter balance for the regulating of the tilting of the bucket. The square frame which carries this bucket is suspended to two steel springs, *gg*, placed as is shown in the drawing, that is, parallel to the register sheet, the object being that when the bucket is emptying, the pencil rises from the register and makes no return mark. The upper ends of these springs are fastened by suitable means to the top of the case. Between the springs and attached to the square frame is an upright rod, *h*, going through a steadying bracket, *i*, and on its upper end an ink pencil, *j*, which delicately touches the sheet of paper moved sideways by the clock, *k*.

The square box alluded to in the preceding paragraph not only affords a support for the gauge, but retains warm air admitted from the gas burner in the room below by means of an iron pipe, *l*, which delivers the heated air close to the bottom of the funnel, melting any snow or sleet that may collect. There is also a metallic thermometer bar in it, which controls a valve at the lower end of the iron pipe, so that the temperature at the bottom of the gauge shall not rise above forty degrees Fahrenheit.



DRAPER'S

RAIN AND SNOW GAUGE.

LITERARY NOTES.

PERIODICALS.

Meteorologische Zeitschrift. Redigirt von Dr. Köppen. Berlin, 1884, November and December.

(68) H. HERTZ: Graphische Methode zur Bestimmung der adiabatischen Zustandsänderungen feuchter Luft; 421-431. An ingenious constructional method, with mathematical demonstration for the determination of the temperature changes in moist air produced by expansion or condensation, such as occur in ascending or descending currents; of especial value in the study of thunder and hail storms.

(69) C. LANG: Ueber Messung der Niederschlagshöhen; 431–437. After showing how untrustworthy many long continued rain-records are, from which it would seem that most of the detailed rainfall maps await serious corrections, the author emphasizes the need of good gauges placed in comparable positions.

(70) W. KÖPPEN: Principien der Vertheilung meteorol. Stationen; 437–443. Stations should be distributed and graded so as to ensure permanence, and to include both similar and contrasted positions. The simple determination of mean temperature, etc., at isolated stations is regarded as not worth the cost, and as standing in the way of the more important aims of the science.

(71) A. WOEIKOF: Klima von Ostsibirien; 443–461. Extended description based on fullest obtainable material; special considerations of the winter *increase* of temperature with altitude, agreeing with Hann rather than Loomis; and of the extent and effects of the great east Asiatic monsoon area.

(72) G. RUNG: Ambrograph mit Sinuswage; 461–464. Description of a self-registering rain-gauge.

(73) LINSS: Ursprung der Gewitterelektricität; 464–467. Atmospheric electricity regarded as unaffected by rain-friction or condensation, but dependent on opposite conditions of air and water vapor.

Several notes by Köppen, Mühry, Penck and others. W. M. D.

Ciel et Terre, Revue populaire d'astronomie, de météorologie et de physique du globe, paraissant le 1re et le 15 de chaque mois, 5th year, No. 23, Feb., 1885. Brussels, 36 pp., subscription (foreign) 10 francs.

(74). F. FOLIE: La cause principale de la direction plongeaute du vent et des calmes tropicaux. This paper is a part of a communication made by the author to the Academy of Sciences of Belgium. The author thinks that the "ducking" or "plunging" of winds is a much more common and important phenomenon than meteorologists have heretofore admitted. He attributes it to the inertia of the air which tends to make the winds take the direction of a tangent to, and thus leave, the earth's surface, to which they must return as soon as they pass into air of less density. The idea may perhaps be profitably applied in the study of our storms, and help to account for the superposition of a cold heavy air on a warmer layer, as it seems to occur in tornadoes.

(75) W. SPRING and E. PROBST: Etude sur les eaux de la Meuse. The conclusion of a study of the waters of the river Meuse. H.

Das Wetter. Published by Dr. R. Assmann, Jan. 1885.

(76). A. V. DANCKELMANN: Die klimatischen Verhältnisse der Westküste von Afrika. 1–8.

The author spent three years on this coast as scientific observer, and is, there-

fore, very competent to discuss its climate. This is the first of a series of articles on the climate, with special reference to its effects on mankind. Of special interest in this number is the author's sketch of the thunder storms of the coast, which we translate:

"By far the greatest part of the rain —all of it in Damara and Herroland, falls during thunder storms, and these have a decided tendency to travel from the east, that is, from the interior toward the coast. In Vivi, for example, out of 73 thunder storms, 57, or near 80 per cent., came from a direction between N. E. and S. E."

"Since these storms, on their approach to the coast, have to cross the West African coast mountains before they can reach the Atlantic, it is proper to designate them as to the lee of the winds bringing rain, and this accounts in part for the dryness of the coast. The approach of the thunder storms to the coast is opposed by the S. W. trades, and one has frequent opportunity to observe the conflict of the two currents, and on this depends occasional failure of rain for long stretches of coast, or long continued drouth, though threatening thunder clouds may be daily seen in the east."

"The cause of this customary course of the thunder storms from E. to W. is one of the most interesting problems of S. W. Africa. It is all the more interesting because Lieutenant Wissmann, whom I requested to keep this point in view on starting out for the first time with Dr. Pogge, for the interior, reports that, in Mangema Land, between the Congo and Tanganika Sea, the thunder storms travel toward the coast of Zanzibar, that is, from the west, and from the interior toward the coast."

"The thunder storms seem in general to have the character of the European "boen," though, from lack of isobaric charts, one can say only that when the storm begins a high wind breaks from great, towering clouds of a dark brown, sometimes blood red, color, contrasting strongly with the gray rain-segment hanging on the horizon; and through this mass, at an elevation of a few hundred metres, sweep in and out ragged cloud fringes."

(77). H. J. KLEIN: Auswärtige und locale Wetterprognosen. 8–11.

Dr. Klein is somewhat pessimistic as to the value of general weather predictions. He thinks that if one predict daily that the weather of to-morrow will be the same as to-day, the predictions will be nearly as generally fulfilled for any locality as will be the general predictions issued by State meteorological services. On actual trial at Cologne during several months, he found that the latter method of prediction gave correct results only 7% less often than the former. At the same time he tried predictions for Cologne (local predictions), from the published weather maps, and found the resulting fulfillment superior to the general predictions by 14%. His general conclusion is that every man must be his own weather prophet. H.

Boletin de la Academia Nacional de Ciencias en Córdoba. República Argentina. Vol. VI., parts 2–4. Buenos Aeres, 1884.

(78) F. AMEGHINO: Escursiones geológicas y paleontológicas en la Provincia de Buenos Aires. pp. 161–248. This is a study of the numerous and curious lagoons of the Argentine Republic. They are of recent origin, and due to the extremely level topography. The author includes in the paper many considerations of Argentine rainfall, and suggestions as to drainage and waterways.

(79) A. DOERING: Estudios hidrognósticos y Perforaciones Artesianas en la República Argentina. 259–340. This is a study of the subterranean waters of the Santiago Railroad, and the limiting salinas. It is largely geological.

(80) O. DOERING: Observations météorologiques faites à Córdoba, pendant l'anneé, 1883. 341–482. The observations are given *in extenso*, and include the usual ones at 7 A. M., 12 M., 2 and 9

P. M.; and also evaporation in the sun and shade, temperature of the soil at depths of 5, 15, 36, 96 and 126 centimetres, and with a thermometer at the surface lightly covered with soil, and solar iradiation. These observations are the continuation of those of the year before, and are in exactly the same form. H.

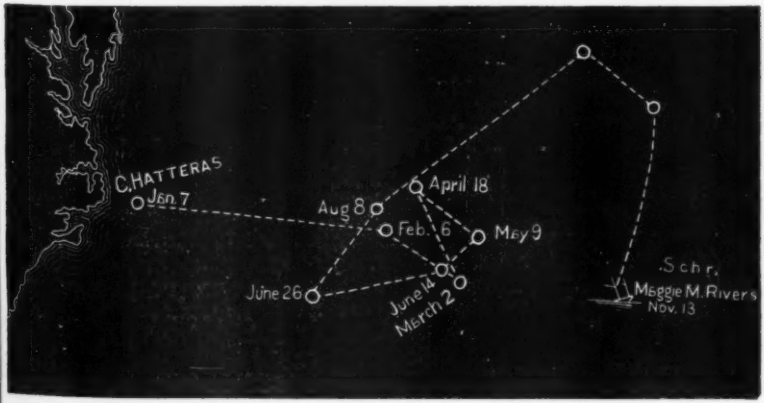
BOOKS, REPORTS, ETC.

(81) **Monthly Weather Review.** (General weather service of the United States). December, 1884. Prepared by H. H. C. Dunwoody. Washington, 1885.

The usual compact review of a month's weather is presented. The addition of the hours of occurrence of high winds, local storms and tornadoes, thunderstorms, halos and polar bands, would greatly improve the value of the record, for the time is past when meteorologists can be satisfied with finding the distribution of these phenomena merely by dates. Their attitude in the passing cyclones (here called 'areas of low barometer'), is a more worthy object of study, and in a country where the cyclones move as fast as they do with us, the day of the month without the hour of the day is too vague an indication of the time of occurrence to serve for this object. The record of the "polar bands" would be further improved by noting their direction and their motion (not always parallel); and the waterspout, mentioned under miscellaneous phenomena, might with advantage be associated with local storms instead. It is questionable whether the record of meteors as here given serves any useful scientific purpose. There is no indication that they are observed regularly or persistently enough to give a good measure of their relative frequency on different dates. Compare, for example, the (apparently) extraordinary numbers counted at Allison, Kansas, in the November *Review*, with those noted at other stations; the difference is of course purely subjective. Certainly most of the records give no information that would serve to refer the meteors to their respective swarms. If the material properly belonging in the *Review* were scanty, this might be an excuse for giving space to extraneous subjects; but there is no lack of strictly meteorological topics that ought to receive attention.

Earthquake records are given space presumably because of the want of space elsewhere—a difficulty that we hope may soon be overcome by their being taken care of by the Geological Survey, where they properly belong. W. M. D.

(82) **The Pilot Chart of the North Atlantic Ocean** appears with commendable promptness. It usually reaches us in the interior on the 3rd or 4th of the month. The schooner Maggie Rivers seems at last to have brought up at the Bahamas on Nov. 13th, after one of the most remarkable voyages on record, as can be seen from the accompanying diagram which we take from the December chart. She was abandoned off Cape Hat-



teras on Jan. 7. A tropical cyclone was between Cuba and Hayti on Oct. 8th, and passing over the Bahamas disappeared on the 17th about 1,000 miles to the northeast. H.

(83) **The Monthly Weather Review for December 1884**, prepared by the Meteorological Service of the Dominion of Canada, has appeared with its usual promptness. It conforms in size of page to our own Monthly Weather Review, prepared at the Signal Office, but is a much less elaborate affair and contains no maps. It consists of ten quarto pages not paged. It devotes two pages to the summary of the *Atmospheric pressure* in the Dominion during the month, one page to minimum temperature, in tabular form, one and one half to precipitation, one to the sunshine record, one to storm warnings and verifications and two to miscellaneous detailed meteorological information from six of the principal stations.

This review contains two features not found in the *Monthly Review* of the Signal Service. One of these is the graphic representation of the amount and direction of the wind at ten principal stations as derived from hourly observations (or tabulations); the second is a review of the magnetic conditions which prevailed during the month as recorded by the magnetographs at Toronto.

Moderate to light magnetic disturbances were noted on the 14th to 16th, 19th, and 21st to 24th with a few fainter ones near the close of the month.

At 7 minutes before midnight of December 15th, the declination magnet was pointing 25′ to the *westward* of its usual position, while about a half an hour later or at 30 minutes past midnight of the 15th it was pointing 28′ to the *eastward* of its normal position. An hour later, and the magnet was at rest in its usual position. These remarkable fluctuations of "the compass" are respectfully commended to the attention of those surveyors who trust their compasses.

Information with respect to the magnetic conditions similar to that obtained at Toronto is recorded in the Magnetic Observatory at Los Angeles, Cal., under the direction of the Coast and Geodetic Survey, but no summary of the results therefrom is published. M. B.

(84) **G. Hellmann.** *Ueber den Jährlichen Gang der Temperatur in Norddeutschland*, with two graphic plates. From the Zeitschrift of the Royal Prussian Statistical Bureau, 1883. 12 pp. 4to.

This, like all of Dr. Hellmann's works, is a model of care, completeness and conciseness, and its few pages give little indication to the ordinary reader of the immense labor involved in its preparation. It is a discussion of the mean pentadic temperatures and their changes, from 35 years observations at 25 German stations. We have not space to note some of the results derived, but they are of very considerable interest. H.

(85) **The "General Meteorological Register for the year 1884,"** is the title of a sixpage pamphlet just issued, giving a summary and abstract of meteorological results obtained at the Magnetical and Meteorological Observatory at Toronto, Canada. So prompt a publication of the results is highly commendable, fresh results being so much more appetizing than stale ones. The work of presenting these interesting results is well done, so well in fact, that we cannot help wishing it were better done, It loses much of its value from the absence of a few explanatory notes which would most satisfactorily fill up its blank space. One great value of the results here set down, is that many of them are derived from *hourly observations*, and not as the average of 3 or 5 (more or less) observations per day. This appears to us a too important fact to be taken for granted. That temperatures are expressed in Fahrenheit degrees and the pressure in inches we may safely assume, though the summary would gain in precision and value by saying so. That the barometric readings have been corrected for temperature and instrumental errors, we may also assume, but shall we assume that they have also been reduced to the level of the sea?

The "resultant velocity of the wind" for the year was 3.30; the mean velocity of the wind in miles per hour, 10.29. The last statement is clear, but does the first explain itself? We beg still further to draw attention to one or two other features which appear to us capable of improvement without serious inconvenience. The title page contains only that which we have above written; what the pamphlet really is, might, we venture to suggest, be more properly characterized as *Magnetical and Meteorological Observatory, Toronto, Canada. Abstract and summary of the meteorological results for the year 1884.*

The heading of the general summary of results seems to us very inaccurately named "General Meteorological Register etc." and we further notice the anomoly of *Meteorological* results from a *Magnetic* Observatory.

The tabulation appears to be accurate; the "mean of cloudiness" for January being given as "0" appears to be the only conspicuous error.

The rainfall and snowfall are given separately, there being no summary for "precipitation." To compare "precipitation" at Toronto with other stations, we should know what factor to multiply its 80.2 inches of snowfall by in order to get its equivalent in water. Of course this is known and needs only a note to state it.

We find no statement relating to earthquakes, and so infer that none were noted; we should feel surer of this inference if we found the statement that no earthquakes were noted. We note with especial pleasure the use of the word "average" in place of "mean." The use of the word *mean*, seems so fixed in usage, that the more accurate but longer word *average* has a most severe struggle for existenee. Its appearance in the pamphlet is timid, but we hope it may become bolder. Thus we have the "*mean* temperature" for 1884, and the "*average* temperature" for 44 years, etc.

The following general abstract of results will prove of interest:

Average atmospheric temp. at Toronto for 1884 (hourly observ.)	43°.79 F.
" " pressure (hourly obs.) (reduced to sea-level)	29.6273
" " humidity (3 observ'ns per day)	0.76
" " elasticity of aqueous vapor, "	0.361
" " cloudiness	0.63
" " velocity of wind in statute miles per hour	10.29
Total rainfall in inches	20.532
" " snowfall "	80.2
" " number of fair days	184
" " " "days rain"	123
" " " "days of snow"	69
" " hours of sunshine	1932
" " " possible sunshine	4463
" " auroras observed	20
" " thunder-storms	30

M. B.

(86) **Ergebnisse der Meteorologischen Beobachtungen im Jahre 1883.** Published by the Royal Met. Inst., and making memoir LXVIII. of the Preussiche Statistik. XIV+158 pp. 4to and 1 map. Berlin, 1884.

This is the official account of the work of the Royal Met. Inst., and is published in accordance with the recommendations of the meteorological congresses. It is edited by Dr. G. Hellmann, and has all the excellent characteristics of his work, besides being typographically unexceptionable. Of especial interest to Americans is the summary of observations taken in 1837–1839 at Fort Confidence, on Great Bear Lake. It is derived from a manuscript which was found among Doue's papers. Though the observer and instruments are unknown, the publication has much interest. In the notes are given the dates of visible auroras and miscellaneous remarks. In 1838 the

thermometer came up to the freezing point on April 24 for the first time, and on June 1st the observer had a delightful walk on the smooth dry ice of the lake, while flowers and willows began to bloom on June 26. It began to freeze again on August 16. In the two years July was the only month in which snow did not fall. The observations began on Oct. 1, 1837 and ended Sept. 26, 1839.

H.

(87) **H. A. Hazen.** *Danger Lines and River Floods of 1882.* Signal Service Notes No. xv. Washington, 1884. 8°, 30 pp.

This pamphlet is reprinted with additions from the annual report of the chief signal officer for 1882. It contains, in a form convenient for reference, all the essential points relating to river gauges, with full notes concerning some of them. On this follow tables of highest and lowest water, with dates and depths, from 1871 to 1883 inclusive, for each of the water gauges. The last ten pages of the pamphlet give an "abstract of a report on the floods of 1882." It gives tabular statements of dates, depths and rainfall and is compiled from nearly 500 reports. The total loss is given approximately at $1,160,000 on the Cumberland, and $9,653,000 and 138 lives on the Mississippi river below Cairo. The author indicates several lines of investigation for the fuller report, to which we look forward with interest. H.

(88) **Observaciones Meteorolojicas hechas en el Observatorio Astronomico de Santiago.** 1873–1881. José Ignacio Vergara, director. Santiago de Chile, 1884. 266+xcvi. pp. 8°, 1 map, numerous plates.

This volume contains the detailed observations at the observatory at Santiago, with an account of instruments, summaries, etc. We note that the observatory has a barograph and a thermograph, both made by Schwandewell of Dresden, which have been running since, apparently, 1873. We also note with interest that the average number of clear days in 9 years has been 183, and of cloudy days 108. Among other data are given the days of earthquakes, from which we learn that they have averaged over 21 per year; as there have been sometimes several earthquakes in one day, the number of shocks for Santiago would probably average two per month. Students of earthquakes will find here an account of that of May 9, 1877, filling 30 pages. The entire volume is one of great interest. H.

(89) **A Bibliography, Guide and Index to Climate.** By *Alexander Ramsay*, F. G. S., etc., etc., etc., London. Sonnenschien and Co. 8°, 449 pp., 16s.

Mr. Ramsay some years ago began publishing the *Scientific Roll* in parts, and issuing them at fairly regular intervals. It was a series of notes taken from scientific publications of all kinds. It was more than a simple bibliography, for the notes gave the substance, and often the words, of the publication to which it referred. It was the note-book of a serious and industrious student, printed as a private enterprise, thus putting it generously at the service of other students. It was an unique and, in this age of the multiplication of books and papers, an important enterprise. The first series of the *Scientific Roll* related to aqueous vapor; this series has been bound together, and now lies before us in a neat and thick volume. It furnishes the raw material for the worker in this subject, and brings the subject down to the beginning of 1884. For the meteorologist who does not possess the publications from which the notes are derived, this book is invaluable, and, for the one who does possess them, it furnishes a guide and index which will soon save him labor to an extent far beyond the cost of the book.

The author proposes to continue his notes in other directions if he can find the necessary support. He wishes only to protect himself from financial loss. As his work is that which every scientific student has either to perform himself or

have others dp for him, and as he is willing to do the work for the bare cost, he deserves the assistance of every one interested in the field which he occupies. There is some advantage in the fact that Mr. Ramsay does not undertake to make a critical digest of the material he works over, but only to present conscientiously the raw materials, letting his reader make his own digest. He has a long series of subjects in meteorology, physical geography, zoology and botany, of any one of which he will begin the publication of notes as soon as he has received the names of 200 proposed subscribers. He can be addressed in care of his publishers.

H.

(90) **Probst.** *Natürliche Warmwasserheizung als Princip der Climatischen Zustände der geologischen Formationen.* From the Abhandlungen der Senckenbergischen naturforschenden Gesellschaft. Frankfort, 1884. 124 pp., 4to.

This is an interesting discussion of a subject which is as properly meteorological as geological, and Dr. Probst gives to it a decidedly meteorological leaning. According to the author the climate of the geological ages up to, and into, the cretaceous was very warm—somewhat warmer than the tropical oceanic climate at present—and was nearly uniform from equator to pole. With the tertiary age came in a gradual differentiation of climate with latitude; this culminated in the glacier period and the climate of the present time.

The cause of the uniformity of early and middle geologic climate, Dr. Probst finds in the lack of continental areas, and the consequent uniform cloudiness outside the tropics, and uniform oceanic currents. With the development of large land surfaces came continental climates, and with their increase and present arrangement came gradually the climate of the present time. The glacial period was only an incident due to the lack of drainage valleys in the recently elevated regions. The masses of frozen precipitation accumulated until, from lack of natural drainage, they gradually crept over extensive areas of lower land and gave them temporarily a vigorous climate. With the development of natural drainage valleys this feature subsided, and the glaciers gradually withdrew to their present extension.

The subject is one on which the author has spent many years, and his memoir has, to an unusual degree, the interest with which a master can invest his topic. The cause given for the glacial period is, so far as we know, new, and may have played no subordinate part.

H.

(91) **A. Lancaster:** Discussion des observations d'orages faites en Belgique pendant l'année, 1879. Bruxelles, 1885; 4to; 36 p. (Extract from *Ann. de l'Obs. roy. de Brux.*) The third year of Belgian thunder-storm observations yields important results confirmatory of those obtained previously, and of much interest in view of the studies lately undertaken in this country. Mr. Lancaster regards thunder storms as cyclonic action on a small scale, developed in the southeastern quadrant of broad cyclonic disturbances, to which the smaller storms may be considered as satellites. The conditions of greatest frequency are: A barometric depression over Ireland or thereabouts, with moderate gradients and an average of 750–755 mm. (sea-level) pressure over Belgium; gentle winds and excessive warmth, so that these storms generally appear in hot quiet weather in the afternoons of the summer months; lower temperature to the west. The storms advance to the northeast at an average velocity of 40–50 kil. an hour, although the surface winds are moving at only a third of that rate; and a sudden fall in temperature accompanies them. Hail-storms are practically unknown on the northwestern side of cyclonic storms. Numerical data are given in support of all these statements except that concerning the cyclonic action of thunder-storms; while regarding this as very probable, we should still wish to see how far it would be supported by a series of synop-

tic maps at half hour intervals of surface winds and cloud motions for a large number of closely placed stations.

—— Appendice (to the above). Observations d'orages faites en Belgique depuis un siècle; 22 p. Thunder-storms recorded during a century in Belgium are most frequent from May to August, with maximum in July; a maximum of storms seems to occur with a minimum of sun-spots. On Feb. 19, 1860, there was a remarkable thunder-storm with snow and many strokes of lightning; an account of it is given in the *Bull. Acad. roy Belg.*, 20, ix, 156 and 263. W. M. D.

(92) **Tennessee Weather Service,** January, 1885. About 1881, the Signal Service feeling the urgent necessity of a closer net-work of stations if effective work was to be done in certain departments of meteorology, endeavored to increase their force of voluntary observers and to arouse organized effort in the different states.

As a result chiefly of their correspondence to the state of Tennessee, Mr. Hawkins, commissioner of agriculture, became sufficiently interested to undertake the establishment of a "State Weather Service."

A number of rain-gauges and thermometers were donated by the Signal Service about the beginning of 1883, and Mr. Hawkins made an appeal for volunteers to join in the struggle for a more complete understanding and mastery of the laws of that science so intimately connected with the welfare and happiness of all. A number of the citizens of Tennessee readily responded to the call, and no doubt a larger number could have been obtained had the supply of instruments been sufficiently large. The first weather report was issued for February, 1883. This contained reports from twenty-two counties, concerning the rainfall, clouds, wind, and miscellaneous phenomena. During March Mr. Hawkins was succeeded by Major McWhirter, who entered on his work with great zeal. The *Report* for March came out with the observations made at twenty-nine stations presented in about the same form as in the February number. The April number came out in improved form, with the observations from thirty-seven stations tabulated. The observations were taken at 7 A. M., 2 and 9 P. M.; and were made on temperature, winds, rainfall, cloudiness, and miscellaneous phenomena, such as dew, fog, frost, thunderstorms, etc. The May and June numbers presented a similar appearance, and contained reports from about forty stations. Commencing with the July number a map was issued each month showing the lines of equal rainfall over the State. With the August number was begun the issue of a diagram on which were drawn lines representing graphically the depth of rainfall at the various stations. With the October number the miscellaneous phenomena reported by the observers began to be much more extensively published, and has formed an important feature in subsequent reports. In December the rainfall began to be represented on the maps accompanying the reports, by a scale of shades like that used in the *Signal Service Weather Review*. The number of stations reporting after April varied from thirty-five to forty-two. Beginning with the January number (1884) there was added a table showing the daily precipitation at each station, and a table showing the comparative precipitations and temperatures at the signal service stations. A chart showing the monthly isothermal lines and prevailing winds, was added with the February number, and the diagram showing the depth of rainfall was discontinued. About this time a donation of twenty-five rain gauges was made to the service by a citizen of Tennessee, which added to the efficiency of the service. A table giving the barometric means for six stations in the State, was begun in the September issue. Up to October the charts were copied by hectograph processes, and appeared detached from the reports; but with this month appeared a neat little engraved map of

Tennessee, incorporated with the *Report*, and containing the isotherms, prevailing winds, and rainfall shades. During December a series of ozone observations were begun at twenty-two stations. Several special tables appeared in the reports during the year, such, for instance, as tables giving first and last frost at a given place for a series of years. The number of stations reporting during the year varied from forty to forty-seven, probably averaging about forty-four. It will thus be seen that there has been a continuous improvement in the reports, and it is to be hoped that they will not only retain their present standpoint, but will continue to improve. A point which seems to thewriter at present very desirable, is that some uniform method of thermometer exposure, with as few objectionable points as possible, be adopted.

The service, like many new enterprises, however, has had to struggle with a want of funds to carry on its enterprise. I understand an effort is to be made during the session of the present legislature to obtain an appropriation for the service, and it is to be sincerely hoped it will be granted.

Fortunately for the service, the work of preparing the reports has fallen into the hands of Major Bate, a gentleman who is not only awake to the importance of the service, but takes a lively interest in its welfare. H. H. C.

(93) **Ohio Meteorological Bureau.** Reports for November (53 pp.) and De cember (54 pp.). Mr. Thos. Mikesell gives phenological observations in Fulton County in each, and in that for December Dr. D. B. Cotton gives the rainfall at Portsmouth for each month of the last 25 years.

(94) **Alabama Weather Service.** Reports for November (15 pp.) and December (12 pp.). That of November includes a map of the isotherms and precipitation for the autumn. It also gives the monthly rainfall since 1868 at Union Springs, and the temperature and rainfall at Mobile since 1871. The railway weather service is progressing well.

(95) **New York Meteorological Service.** Abstract of registers for November.

(96) **Indiana Volunteer Weather Service.** Prof. W. H. Ragan, director. Greencastle, Ind., November. 33 stations.

CORRESPONDENCE.

To the Editor:—On the 22nd of Dec. '84, a thunder-cloud passed over us, and about five miles further on developed into a limited tornado, striking exactly where the tornado of April 23d, 1883, left off. The up-draught of this appears to me to have been greater than in that of April 23d, 1883, from the number of small branches of the broken pine-trees, strewn indescriminately about. I could only find two cases in which the fallen trees crossed each other, and in these the trees falling from the west were on top, as in the previous storm track. I notice that Prof. Davis, in his little work on storms, says that "electricity has no important part to play in the disturbance." There are some facts which come up to mind connected with the 3 storms which have lately passed near me, which cause me to think that perhaps electricity does play an important part, but I have not time now to present them to you. yours truly,

W. W. Anderson.

Statesburg, S. C., Jan. 31, 1885.

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Ann Arbor, Mich., Oct. 1st, 1884